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Loans for roads, bridges, schools, municipal and provincial buildings, etc., from Dec. 28, 1912, to Mar. 25, 1913—Continued.

Provinces and projects.	Acts—						
	1666.	1728.	1729.	1749.	1979.	2083.	Total.
Isabela: For the purpose of repaying first installment recently granted for completion of provincial building, jail, and high school		₱2,500					₱2,500
Pampanga:							
Share of the cost of drilling artesian wells, Arayat, Pampanga		2,000					2,000
Macabebe market						₱18,000	18,000
Rizal: Purchase of central school building and lot, Mariquina						4,000	4,000
Tayabas: Central school building, Atimonan				₱4,000			4,000
Total		4,500	₱7,500	22,300	2,000	61,600	97,900

The loans stated in the foregoing table are repayable as follows:

BOHOL.

For the purpose of erecting a modern market and acquiring a site therefor, a loan of ₱10,500 is hereby granted the municipality of Maribojoc, province of Bohol, payable in ten annual installments due in one, two, three, four, five, six, seven, eight, nine, and ten years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of not to exceed 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Bohol, who should be advised accordingly. Three thousand nine hundred pesos of this loan will be made from the friar lands bond sinking fund, created by Act No. 1749, and ₱6,600 from the gold standard fund created by Act No. 2083. The loan from the gold standard fund will bear interest at the rate of 3 per cent, and the loan from the fund created by Act No. 1749 will bear interest at the rate of 4 per cent per annum. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act. No. 1749.		Act. No. 2083.	
	Principal.	Interest.	Principal.	Interest.
First	₱500.00	₱156.00		₱198.00
Second	500.00	136.00		198.00
Third	800.00	116.00		198.00
Fourth	800.00	84.00		198.00
Fifth	1,300.00	52.00		198.00
Sixth			₱1,300.00	198.00
Seventh			1,300.00	159.00
Eighth			1,300.00	120.00
Ninth			1,300.00	81.00
Tenth			1,400.00	42.00

For the purpose of erecting a modern market, a loan of ₱6,000 is hereby granted the municipality of Loon, Province of Bohol, payable in ten equal annual installments due in one, two, three, four, five, six, seven, eight, nine, and ten years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of not to exceed 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Bohol who should be advised accordingly. Three thousand pesos of this loan will be made from the fund created by Act No. 1749, and ₱3,000 from the gold standard fund created by Act No. 2083. The loan from the gold standard fund will bear interest at 3 per cent per annum and the loan from the fund created by Act No. 1749 will bear interest at 4 per cent per annum. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act. No. 1749.		Act. No. 2083.	
	Principal.	Interest.	Principal.	Interest.
First	₱600.00	₱120.00		₱90.00
Second	600.00	96.00		90.00
Third	600.00	72.00		90.00
Fourth	600.00	48.00		90.00
Fifth	600.00	24.00		90.00
Sixth			₱600.00	90.00
Seventh			600.00	72.00
Eighth			600.00	54.00
Ninth			600.00	36.00
Tenth			600.00	18.00

BATANGAS.

For the purpose of constructing the Sabang Bridge, an additional loan of ₱15,000 is hereby granted the Province of Batangas payable in five equal annual installments due in six, seven, eight, nine, and ten years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of 3 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Batangas who should be advised accordingly. This loan will be made from the gold standard fund created by Act No. 2083. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act No. 2083.	
	Principal.	Interest.
First		₱450.00
Second		450.00
Third		450.00
Fourth		450.00
Fifth		450.00
Sixth	₱3,000.00	450.00
Seventh	3,000.00	360.00
Eighth	3,000.00	270.00
Ninth	3,000.00	180.00
Tenth	3,000.00	90.00

BULACAN.

Referring to your resolution of the 31st ultimo, granting to the municipality of Meycauayan a provincial loan of ₱2,000, payable ₱320 on December 15, 1913, and ₱280 each year thereafter until the loan is entirely repaid, together with interest, payable semiannually, at the rate of 3 per cent per annum, for the construction of its public market, I have to advise you that the same is hereby approved, by authority of the Governor-General, under the provisions of Act No. 1979; provided that the total indebtedness of the said municipality, including this loan, but exclusive of Insular loans, if any, does not exceed 5 per cent of the assessed valuation of taxable property therein.

For the purpose of erecting a central school building, a loan of ₱2,500 is hereby granted the municipality of Malolos, Province of Bulacan, payable in one year from the date of the loan, together with interest, payable quarterly, at the rate of 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Bulacan, who should be advised accordingly. This loan will be made from the fund created by Act No. 1729. The payment, including interest due, when collected, will be credited as follows:

Payments.	Act No. 1729.	
	Principal.	Interest.
First	₱2,500.00	₱100.00

CEBU.

For the purpose of purchasing a market site and erecting a modern market thereon, a loan of ₱15,000 is hereby granted the municipality of Oslob, Cebu, payable in ten equal annual installments due in one, two, three, four, five, six, seven, eight, nine, and ten years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of not to exceed 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Cebu, who should be advised accordingly. Five thousand pesos of this loan will be made from the funds created by Act No. 1749, and ₱10,000 from the gold standard fund created by Act No. 2083. The loan from the gold standard fund will bear interest at the rate of 3 per cent per annum, and the loan from the fund created by Act No. 1749 will bear interest at the rate of 4 per cent per annum. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act No. 1749.		Act No. 2083.	
	Principal.	Interest.	Principal.	Interest.
First	₱750.00	₱200.00		₱300.00
Second	750.00	170.00		300.00
Third	750.00	140.00		300.00
Fourth	750.00	110.00		300.00
Fifth	2,000.00	80.00		300.00
Sixth			₱2,000.00	300.00
Seventh			2,000.00	240.00
Eighth			2,000.00	180.00
Ninth			2,000.00	120.00
Tenth			2,000.00	60.00

CAGAYAN.

For the purpose of completing the new jail and court building, an additional loan of ₱6,400 is hereby granted the Province of Cagayan, payable in two equal annual installments, due in three and four years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Cagayan who should be advised accordingly. This loan will be made from the fund created by Act No. 1749. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act No. 1749	
	Principal.	Interest.
First		₱256.00
Second		256.00
Third	₱3,200.00	256.00
Fourth	3,200.00	128.00

CAPIZ.

For the purpose of constructing a wharf, a loan of ₱10,000 is hereby granted the municipality of New Washington, Province of Capiz, payable in ten equal annual installments due in one, two, three, four, five, six, seven, eight, nine, and ten years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of not to exceed 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Capiz, who should be advised accordingly. Five thousand pesos of this loan will be made from the funds created by Act No. 1729, and ₱5,000 from the gold standard fund created by Act No. 2083. The loan from the gold standard fund will bear interest at the rate of 3 per cent per annum, and the loan from the fund created by Act No. 1729 will bear interest at the rate of 4 per cent per annum. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act No. 1729.		Act No. 2083.	
	Principal.	Interest.	Principal.	Interest.
First	₱1,000.00	₱200.00		₱150.00
Second	1,000.00	160.00		150.00
Third	1,000.00	120.00		150.00
Fourth	1,000.00	80.00		150.00
Fifth	1,000.00	40.00		150.00
Sixth			₱1,000.00	150.00
Seventh			1,000.00	120.00
Eighth			1,000.00	90.00
Ninth			1,000.00	60.00
Tenth			1,000.00	30.00

ISABELA.

For the purpose of repaying the first installment, due January 3, 1913, on the loan granted by the letter of the Governor-General, dated December 28, 1910, to the Province of Isabela for the completion of the provincial building, jail, and high school, a loan of ₱2,500 is hereby granted the Province of Isabela effective as of January 3, 1913, payable on July 3, 1913, together with interest at the rate of 4 per cent per annum. This loan will be made from the insurance fund created by Act No. 1728.

PAMPANGA.

For the purpose of meeting the municipal share of the cost of drilling artesian wells a loan of ₱2,000 is hereby granted the municipality of Arayat, Province of Pampanga, payable in two equal annual installments due in one and two years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Pampanga, who should be advised accordingly. This loan will be made from the insurance fund created by Act No. 1728. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act No. 1728.	
	Principal.	Interest.
First	₱1,000.00	₱80.00
Second	1,000.00	40.00

For the purpose of erecting modern market buildings, a loan of ₱18,000 is hereby granted the municipality of Macabebe, Province of Pampanga, payable in ten equal annual installments due in one, two, three, four, five, six, seven, eight, nine, and ten years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of 3 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Pampanga who should be advised accordingly. This loan will be made from the gold standard fund created by Act No. 2083.

RIZAL.

For the purpose of purchasing a building and lot to be used as a central school building and site, a loan of ₱4,000 is hereby granted the municipality of Mariquina, Province of Rizal, payable in ten equal annual installments due in one, two, three, four, five, six, seven, eight, nine, and ten years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of 3 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Rizal, who should be advised accordingly. This loan will be made from the gold standard fund created by Act No. 2083. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act No. 2083.	
	Principal.	Interest.
First	₱400.00	₱120.00
Second	400.00	108.00
Third	400.00	96.00
Fourth	400.00	84.00
Fifth	400.00	72.00
Sixth	400.00	60.00
Seventh	400.00	48.00
Eighth	400.00	36.00
Ninth	400.00	24.00
Tenth	400.00	12.00

TAYABAS.

For the purpose of completing the erection of its central school building, a loan of ₱4,000 is hereby granted the municipality of Atimonan, Province of Tayabas, payable in four equal annual installments due in one, two, three, and four years, respectively, from the date of the loan, together with interest, payable quarterly, at the rate of 4 per cent per annum. It is requested that the said amount be placed for disbursement to the credit of the provincial treasurer of Tayabas who should be advised accordingly. This loan will be made from the fund created by Act No. 1749. The annual payments, including interest due, when collected, will be credited as follows:

Payments.	Act No. 1749.	
	Principal.	Interest.
First	₱1,000.00	₱160.00
Second	1,000.00	120.00
Third	1,000.00	80.00
Fourth	1,000.00	40.00

GENERAL ITEMS.

A GOOD ROADS ASSOCIATION IN THE STATE OF NEW SOUTH WALES.

A good roads association has been formed in the State of New South Wales, the object being to urge the improvement of roads in every possible way. It appears that suburban roads have seriously deteriorated through lack of proper construction and maintenance, due to the decentralization of authority. We republish the following from the "Commercial Motor:"

A strong agitation for better roads has been going on in the State of New South Wales. Particularly during the last few years the state of the roads generally, and of suburban roads most of all, has been getting worse and worse, until to-day it is really dangerous to drive over some of the main suburban roads around Sydney. This question has some passing interest to those concerned in the road question in England, as it emphasizes the result of the splitting up of road maintenance among a large body of local authorities.

Up to five years ago, the maintenance of the roads in this State was a question for the Government, and, considering the sparse population, they were a credit to the community. At this period an act was passed placing the control and maintenance of the roads under the various local authorities and shire councils, with the result that they have steadily deteriorated, while the cost of maintenance has increased, until they are now an absolute scandal.

Standard plan No. 1.

COST OF SCHOOL BUILDINGS.

Bureau of Education standard plan school buildings reported completed by district engineers, and accepted by the Director of Education, for the period July 1, 1912, to February 11, 1913, together with some special construction and reconstruction projects.

Plan No. 1.

Province and municipality.	Appropriation.	Miscellaneous.	Labor.	Materials.	Surcharges.	Total.
Albay:						
Albay (Lacag)	₱2,725.79	₱54.72	₱2,014.25		₱152.52	₱2,719.57
Batangas:						
Taal (Balibago)	3,149.98	551.27	780.00	₱1,453.98	81.38	2,866.63
Cebu:						
Mandawe (Consolacion)	3,600.00		1,477.64	1,280.65	241.64	2,999.93
Ilocos Norte:						
Bangui (Nagpartian)	2,860.89	113.39	1,758.05	1,372.79	199.92	3,443.15
San Miguel (Pangdan)	2,221.69	1,963.94	19.60	152.46	210.45	2,346.45
Bacarra (Candarantan)	2,545.42	2,401.41			144.01	2,545.42
San Miguel (Golgol)	2,142.82	2,118.80			241.02	2,359.82
San Nicolas (Bingao)	2,461.05	2.269.45			251.76	2,521.21
San Nicolas (Payas)	2,760.00	2,460.00			245.99	2,705.99
Paoay (Currimao)	2,622.00	2,189.24		190.84	234.58	2,614.66
Misamis:						
Cagayan (Gusa)	2,921.50	12.50	1,034.54	1,598.97	275.11	2,921.12

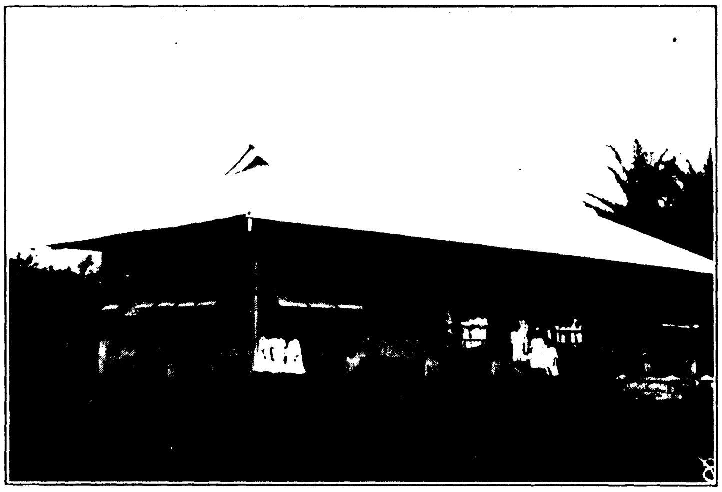
Plan No. 2.

Province and municipality.	Appropriation.	Miscellaneous.	Labor.	Materials.	Surcharges.	Total.
Albay:						
Malinao (Tanauan)	₱4,933.67		₱4,708.33		₱233.34	₱4,943.67
Albay (Jonapon)	5,477.03	₱190.49	1.154.11	₱3,783.29	301.40	5,427.29
Albay (Gapo)	4,766.67	89.85	1,158.90	3,212.94	267.09	4,728.78
Malinao (Tagoytoy)	4,967.67					4,967.67
Ambos Camarines:						
Buhi (Central)	5,066.67	205.46	38.17	4,281.92	258.43	4,783.98
Bohol:						
Candihay (Cogtong)	6,229.00					4,592.15
Candihay (Butuanan)	6,341.00	1,121.40	1,688.52	1,507.21	213.90	4,391.00
Cebu:						
Sibonga (Simala)	5.050.00					4,973.04
Ilocos Sur:						
Santa Lucia (Salcedo)	5,250.00	438.71	1,367.03	2,857.73	394.51	5,057.98
Santa Cruz (Sevilla)	4,823.33	217.61	1,245.21	2,935.21	598.67	4,807.14
Candon (Ayudante)	4,800.00	268.05	920.33	2,811.16	480.00	4,479.54
Laguna:						
Cavinti (Bucal)	3,000.00	156.73	1,227.77	772.23	155.95	2,312.68
Samar:						
Santa Margarita (central	8,800.00	9.15	8,200.00		418.02	8,627.17
Sorsogon:						
Bulan (San Francisco)	4,950.00	59.39	1,854.96	2,699.37	316.95	4,930.67
Bulan (San Roque)	3,900.00	52.50	1,359.83	2,247.42	214.45	3,874.20
Bulan (San Ramon)	4,500.00	56.55	1,661.40	2,444.69	313.64	4,476.28
Sorsogon (Guinlajon)	3,900.00		1,777.56	1,873.11	217.07	3,867.74
Surigao:						
Hinatuan (Barcelona)	5,430.00	360.00	1,425.00	3,259.50	265.50	5,310.00
Hinatuan (Bislig)	5,430.00	360.00	1,425.00	3,259.50	265.50	5,310.00
Tarlac:						
Maliualo	4,500.00	9.75	1,166.81	2,742.30	354.28	4,337.14
Tarlac (San Clemente)	2,784.50	12.90	808.07	1.751.19	204.27	2,776.43

Standard plan No. 2.

Plan No. 3.

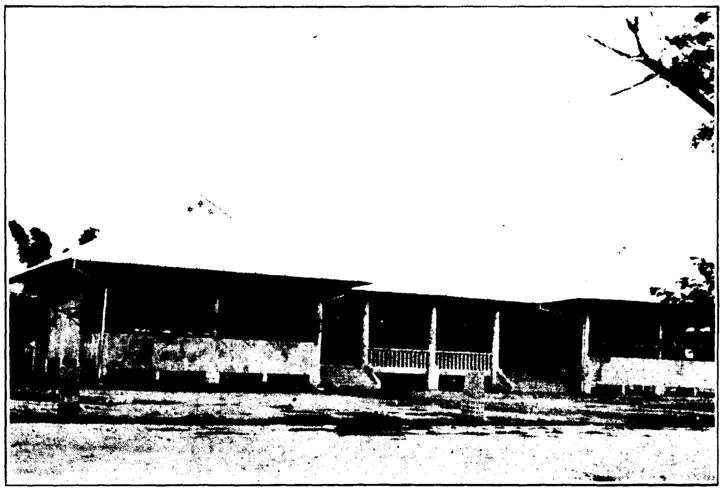
Ambos Camarines:						
Baao (central)	₱6,408.19	₱91.75	₱176.02	₱5,785.49	₱354.93	₱6,408.19
Goa (central)	6,900.00	278.53	1,488.10	4,525.99	380.46	6,673.08
Capiz:						
New Washington (Panay)	6,300.00	278.25	1,862.20	4,150.11		6,290.56
Cebu:						
Liloan (central)	6,506.17	159.04	1,990.30	3,965.86	390.97	6,506.17
Ilocos Norte:						
Batac (Banna)	6,937.13					6,937.13
Solsona (central)	7,163.34	6,487.90	230.50	1,126.84	669.94	8,515.18
Ilocos Sur:						
Santiago	7,500.00	524.63	1,909.01	3,887.83	750.78	7,072.25
Santo Domingo (central)	7,500.00	307.41	1,703.62	4,581.77	825.06	7,417.86
La Union:						
Bauang (central)	7,691.50	55.79	2,308.55	4,623.74	514.78	7,502.86
Occidental Negros:						
Sagay (central)	7,938.80	221.18	7,000.00		446.28	7,667.46
Silay (with 2 additional rooms)	11,600.00	555.79	4,052.31	7,060.15	639.07	12,307.32
Pangasinan:						
Alcala (central)	7,000.00	118.57	2,223.97	3,348.47	484.20	6,175.21
Rizal:						
San Pedro Macati (central)	7,700.00					7,700.00
Samar:						
Gandara (central)	9,136.13					9,130.00
Bobon (central)	9,299.17					9,366.51
Sorsogon:						
San Jacinto (central)	6,238.50	30.62	2,684.36	3,145.06	361.68	6,221.72
Zambales:						
San Marcelino (Castillejos)	7,100.00	144.26	2,126.36	4,469.15	356.27	7,096.04
Tarlac:						
Capas (central)	6,500.00	51.01	1,730.57	4,221.33	473.28	6,476.19



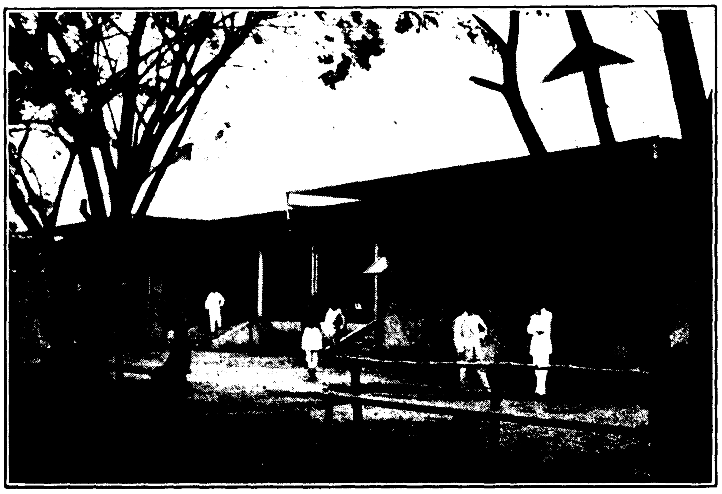
Standard plan No. 3.

Plan No. 5.

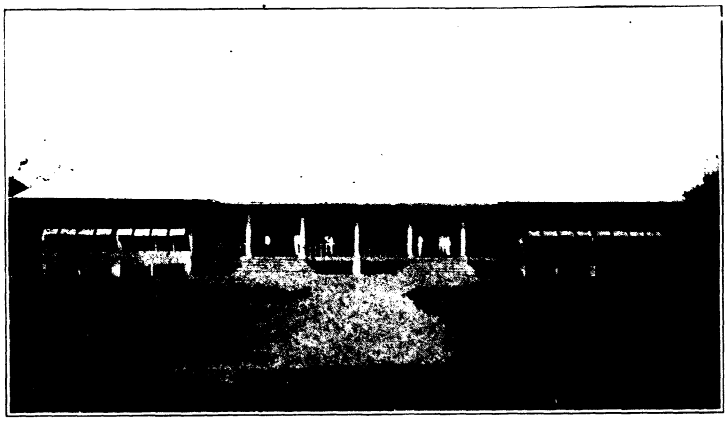
Province and municipality.	Appropriation.	Miscellaneous.	Labor.	Materials.	Surcharges.	Total.
Laguna:						
Los Baños (central)	₱7,303.83	₱776.87	₱1,748.68	₱4.452.81	₱325.47	₱7,303.83
Rizal:						
Caloocan (central)	13,500.00	968.38	4,284.18	7,217.06	859.67	13,347.29



Standard plan No. 6 showing old style of pier and porch rail.



Standard plan No. 6 with revised piers.



Standard plan No. 7.

Plan No. 6.

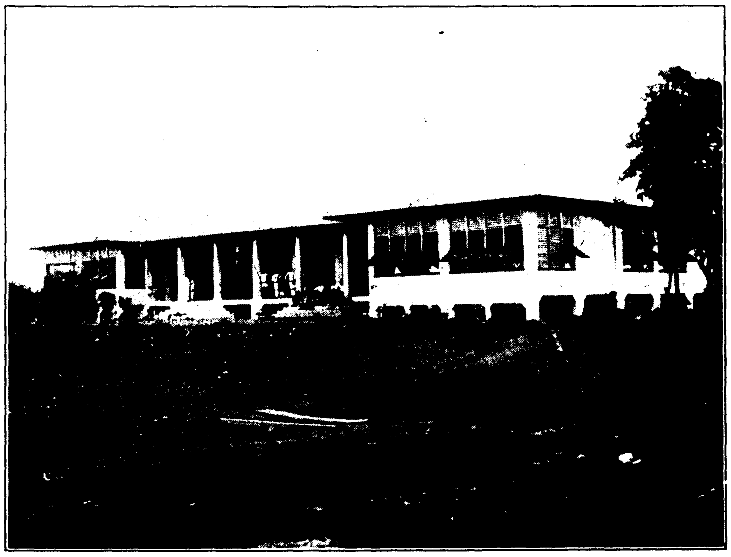
Province and municipality.	Appropriation.	Miscellaneous.	Labor.	Materials.	Surcharges.	Total.
Ambos Camarines:						
Tigaon (central)	₱9,000.00	₱221.08	₱1,651.87	₱5,910.19	₱484.76	₱8,267.90
Occidental Negros:						
Talisay (central)	12,630.00	653.51	4,344.04	6,870.03	694.36	12,561.94
San Carlos (central)	12,400.00	389.66	11,756.25		514.38	12,660.29
Pampanga:						
San Luis (Santo Tomas)	9,271.46	382.97	2,879.06	5,083.26	926.17	9,271.46
Sorsogon:						
Gubat (central)	13,212.16		4,340.80	7,856.80	896.91	13 094.51
Bulan (central)	11,200.00		3,547.04	6,565.06	604.44	10,716.54
Tarlac:						
Gerona (central)	11,847.50	92.14	2,847.46	7,325.27	1.009.97	11,274.84

Plan No. 7.

Albay:						
Virac (central)	₱17,606.72	₱830.66	₱14,850.00	₱328.00	₱1,598.06	₱17,606.02
Antique:						
San Jose (central)	16,697.06					16,697.06
Zambales:						
San Antonio (central)	15,513.68	226.29	3,556.65	9,752.70	1,838.32	15,373.96

Plan No. 10.

Ambos Camarines:						
Nueva Caceres (central)	₱20,004.38	₱1,639.16	₱258.06	₱17,744.72	₱361.40	₱20,003.34
Antique:						
San Jose (central)	21,747.25					21,747.25
Bataan:						
Balanga	22,880.45					21,863.52
Laguna:						
San Pablo (with 2 extra rooms)	32,779.52	28,514.57			1,668.70	30,183.27
Pampanga:						
Angeles (central)	20,317.50	245.29	4,762.53	12,388.14	2,635.91	20,031.87
Lubao (central)	18,609.01	15,816.19	905.37	25.20	1,862.25	18,609.01



Standard plan No. 10.

Reconstruction.

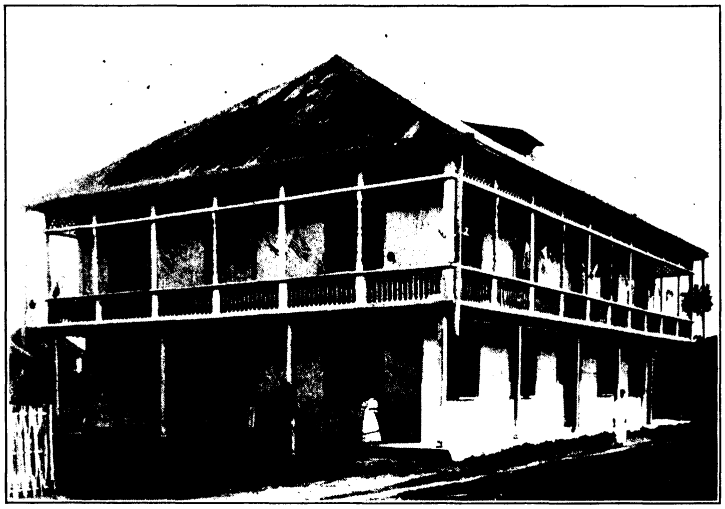
Province and municipality.	Appropriation.	Miscellaneous.	Labor.	Materials.	Surcharges.	Total.
Ambos Camarines:						
Paracale	₱4,800.00	₱1,569.25	₱1,491.34	₱2,561.81	₱292.88	₱5,919.28
Antique:						
Sibalom (central)	8,891.91					8,891.91
San Jose (central)	5,680.90					5,680.90
Batangas:						
Batangas (central)	6,600.00	123.41	2,200.00	3,800.00	363.53	6,486.94
Cebu:						
Sibonga (central)	7,150.00	494.42	3,592.59	2,633.99	429.00	7,150.00
Ilocos Norte:						
Vintar	8,050.66	7,113.83	17.86		733.49	7,865.18
Laoag (central)	5,660.00	3,708.15			51.48	3,759.63
Iloilo:						
Miagao (central)	6,500.00	1,218.62	2,254.33	2,359,19		5,832,14
Laguna:						
Majayjay (central)	3,000.00	534.48	700.41	1,525.62	164.42	2,924.93
Leyte:						
Caibiran	4,554.73					4,554.73
Pangasinan:						
Manaoag (central)	3,150.94	829.53	958.45	1,212.18	201.95	3,202.11
Rizal:						
San Mateo (central)	8,015.00	134.36	2,158.85	5,037.97	530.86	7,862.04

Trade School.

Province and municipality.	Appropriation.	Miscellaneous.	Labor.	Materials.	Surcharges.	Total.
Albay:						
Albay	₱13,300.00	₱14.80	₱10,250.00	₱750.55	₱1,083.39	₱12,098.78
Bohol:						
Tagbilaran	2,250.00		506.86	1,437.59	261.83	2,206.28

Domestic Science.

Province and municipality.	Appropriation.	Miscellaneous.	Labor.	Materials.	Surcharges.	Total.
Bohol:						
Bohol	₱6,961.20	₱1,966.65	₱2,019.90	₱2,772.08	₱202.57	₱6.961.20



Types of reconstruction projects.

Experience has shown that it usually costs more to remodel an old building than to erect a new one, and that the arrangement of class rooms in such buildings is unsatisfactory for school purposes.

THE TASK SYSTEM AS USED ON THE DUEÑAS-LAMBUNAO VIEJO ROAD, ILOILO PROVINCE.

The task or "paquiao" system, as it is called in the Philippines, is the letting out of small pieces of work to squads of native laborers at a stipulated price; the work to be done in a given contract time.

This is a well-known method for getting out gravel, stone, timber, piles, etc., and also for making "rice paddy" fills for road embankments; but is not generally employed in building roads subgrade through hills or rough land, because of the difficulty of getting laborers with intelligence enough to follow the stakes and thus get their ditches and slopes made in an acceptable manner.

When the construction of the Dueñas-Lambunao Viejo Road started in August, 1912, most all of the work was done by day labor at 50 centavos a day. This being near the towns of Dueñas and Passi, there was plenty of labor, and dirt was moved for 47 centavos, including all surcharges. However, as the construction moved farther from these towns, labor became scarcer, until in December a mere handfull of laborers remained. Finally the superintendence and surcharges exceeded the actual cost of moving the dirt, making the total cost 80 centavos per cubic meter.

These discouraging figures brought about a demand for some scheme to draw laborers. It had been noticed in several places, where there were "rice paddy" fills, that men could be more easily obtained by letting out single stations to small squads of men, at a figure a little less than the cost of doing it by day labor; but, owing to the many difficulties arising from the ignorance of the men, no cut and fill or rough work had been done under this system. The men did not understand sloping or ditching and were slow to consider a contract of that kind, because of their not being able to judge in the least as to what kind of a contract they would be making; and, with their usual suspicion, would not trust anyone else.

However, it was decided to try the "paquiao" system in all classes of work. At first considerable difficulty was encountered. The men were prone to leave their slopes irregular and rough, to leave their ditches unfinished, and to waste the dirt they had agreed to haul. They would also wrangle about the price, fearing that they were being beaten.

But they have learned. They now finish their work neatly and never question the price, because they have confidence in the public works agent and have respect for his idea of how a thing should be done. They come from all directions; work early and late, and at times of moonlight work far into the night. In this way the best of them earn 80 centavos per day.

At present everything is done by "paquiao." Only enough day laborers are retained to do the stations that are too small to "paquiao," and to finish such stations as are not completed by the haul from the contracted cuts. During the month of January, under this system, the cost of earth work fell to 45 centavos per cubic meter including all charges, notwithstanding the fact that the first ten days were almost entirely without labor.

There are several details in connection with this class of contract work which are more important than in the day-labor system. In the first place, the foreman must be reliable and painstaking and must understand handling local labor. Hubs must be driven at each break in the cross-section of the roadbed, as under Plate No. 1, and all cuts and fills marked with reference to the top of these hubs. It is not sufficient to take the elevations of the top of the ground and mark the cut or fill, because the stations are scarcely ever finished consecutively and discrepancies which would arise because of the unevenness of the ground would produce irregularities in the roadbed, which in case of day labor are avoided by stretching

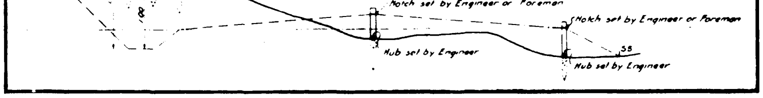

Notches set in stakes by Engineer or Foreman
Cut 1.00 meter from notch in stake placed by Engineer or Foreman
Cut 60 cm (from top of hub set by Engineer)
SS
Notch set by Engineer or Foreman
Notch set by Engineer or Foreman
Hub set by Engineer
Hub set by Engineer
SS

Plate I.

grade lines. When these hubs are set the foreman or his assistants can set stakes and make notches in them at even meters or fractions thereof above or below the finished points of the grade and the "taos" will soon learn to do the rest.

Besides the setting of the hubs and the figuring of the quantity of each station, with the information as to haul, the success of this kind of work depends entirely upon the foreman. The foreman on the Dueñas-Lambunao Viejo Road has been extremely successful in this work. The following notes gathered from the foreman's point of view will give a good idea of the most successful manner of handling "paquiao" work:

"Paquiao" with the laborers direct, if possible, and not through a middleman.

Occasionally a gang will ask that the price of their work be increased, claiming that they are making less than ordinary wages, but generally, if looked into, it will develop that they have made a mistake in figuring their shares.

As a rule, they will want to turn in their work a little short of completion, and a foreman must be well onto the job, for where a large number are working they will skimp the work unless apprehended. A little jollying goes a long way with the laborers; but one needs to know and understand them to do this effectively. They are ever ready to be "shown."

In "paquiao" cuts and fills it is always better to contract the cuts, arranging in the agreement for the dirt to be so deposited that the stations to which the dirt is hauled will be completed—that is, not allowing more than one station of fill to be incomplete when the cut is finished; then if there are any stations left for "fill," they can be "paquiao" as "borrow and fill," and the remaining station can be finished by day labor. In this way many stations of "fill" are often completed free of charge where the haul is not more than 40 meters.

COGON THATCH PROTECTION FOR HIGH ROAD FILLS.

The Sual Hill diversion on the Lingayen-Alaminos Road, Pangasinan Province, crosses a deep ravine at station 19+ 410 with a fill 12.8 meters high and 57 meters long on top, the highest road fill in the Islands as reported to date. By means of this fill it was possible to cut out four curves of less than 20 meters' radius each and about 300 lineal meters of very steep side-hill work.

The diversion itself represents the fourth and only successful attempt to put a road cross Sual Hill on a practicable grade and alignment. Two roads were built under the Spanish régime. One of these swings nearly a kilometer to the north of the present location, breaking through the ridge with a cut 40 feet deep, only to come back along the side of the hill for 500 meters on a grade almost level and then to drop abruptly to the tidal plain in a series of dangerous curves and grades. In the second attempt, crossing the ridge with a 20-foot cut, which, by the way, was utilized in locating the present road, the alignment is very good indeed, but contour lines are treated with contempt and grades as steep as 25 per cent are the result. The American military government built the third road, on the same location as the second as nearly as possible, and brought the grades down to a maximum of 16 per cent.

The present road is built on a grade of 6 per cent with curves having a minimum radius of 40 meters. Low ridges are followed wherever possible, with the result that only 3 culverts were required on the hill section of about 1 kilometer in length. One of these is a 100-centimeter cylindrical pipe 37 meters long placed in the bottom of the big fill. The shoulder width of the grade is 6.30 meters, with wide, shallow ditches.

Following are the dimensions of the fill:

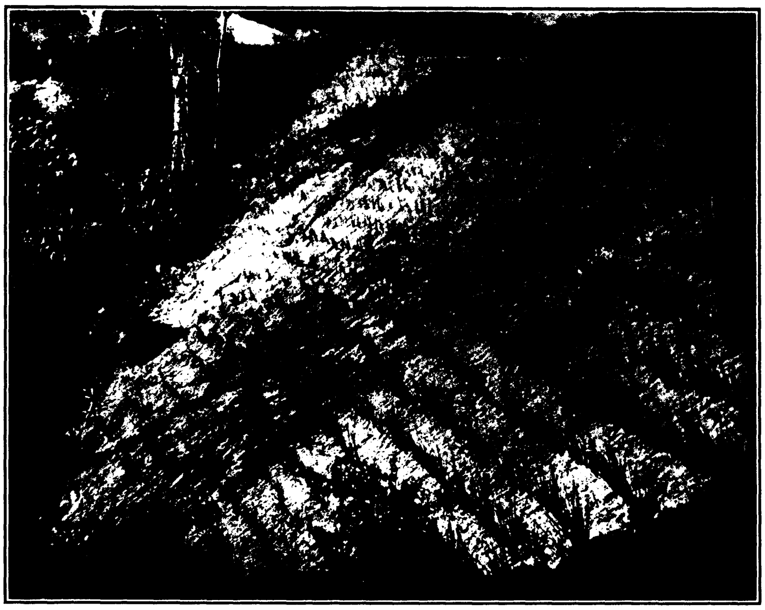
Width on top	meters	4.0
Width at bottom	do	37.0
Greatest depth	do	12.0
Length on top	do	57.0
Volume	cubic meters	5,300
Average slope of sides		1.2 to 1
Area of cogon thatch	square meters	1,200
Unit cost of thatch per square meter		₱0.045

The fill was completed only just before the first hard rains of the 1912 season and suffered considerably from wash, although the top was well protected by the road surfacing. The material, a rather finely divided white clay, did not pack readily, so that even the thread-like rivulets of water caught by the roadway were sufficient to cut gashes 2 meters deep in the sides of the fill.

There was not time for a sod protection to take root before succeeding deluges were to be expected, so the cogon thatch was resorted to as a present means of preservation, each section of the fill being protected as quickly as the damage could be repaired.

The material used is described as follows:

> This plant is a perennial grass growing from 3 to 5 feet high, common in the Philippine Islands and southeastern Asia. It has high, narrow, silvery-silky panicles. It is so hardy in its growth and habitat that it smothers out all other plants in its territory.—*Botanical Department, Lingayen High School.*



Cogon-grass mat on high fills, showing new grass growing through.

The cogon grass was cut as long as possible, the average being about 1.5 meters, and was brought to the work in *manojitos* about 5 centimeters in diameter. These small bundles were laid close together against the side of the fill, and parallel to its slope, the butts being brought to a line and placed uphill. The *manojitos* were pegged down by driving a short bamboo hook, 10 centimeters from the butts, over each one into the fill. Each course was pegged down about 50 centimeters farther up the slope than the one last placed, depending upon the length of the cogon stems. No wire, poles, stones, or other fastening device except the pegs was employed, and the very satisfactory stability of the thatch under the heavy downpours of rain that came later in the season demonstrated that the pegs were sufficient. Not the slightest wash could be detected on any part of the fill protected by the thatch.

The durability of this cogon "roof" is rather surprising. The first Hermosa dike on the Agno River below Bayambang was protected by a thatch laid in May, 1912, somewhat after the manner just described, and ten months later it was still in fairly good condition. Cogon plants were set at intervals of about 30 by 70 centimeters all over the sides of the Sual Hill embankment. The planter merely inserted a sharpened stick through the thatch, making a hole in the earth beneath, in which the cogon stool was set. The grass grows and spreads with great rapidity, so that by the time the thatch has rotted to the point of unserviceability, the growing cogon will be furnishing ample protection to the fill.

Two points in the economy of this seemingly makeshift method of protection for earth fills should be noted. The stability of the fill through its first rainy season is assured, and ample time is given for the growth of living cogon plants for a permanent protection; or, if convenient and desirable, sodding may be carried on while the rains are in progress by removing the thatch from small portions of the fill at a time. The second point appears in the steep slopes at which earth, protected in this manner, will stand. Permanency of grade is the main object sought in unavoidably high road fills, and where this can be made compatible with steep side slopes, a very satisfactory diminution of volume must result, always considerably more than sufficient to pay the cost of the cogon thatch.

RESULTS ACCOMPLISHED BY BOHOL PROVINCIAL LAUNCH.

After an experience of two and a half years, the provincial treasurer of Bohol Province, Mr. P. J. Vanden Broeck, has been able to furnish some valuable data on running a provincial launch that should be of unusual interest to other provinces, destitute of local transportation facilities, for the needs of public works or provincial business.

The nearest point of the east coast of Bohol Island to the port of Cebu is 40 kilometers, while Tagbilaran, the capital of the province, is 80 kilometers, much of it through the open sea subject to strong ocean currents and severe weather conditions.

Practically the entire Island of Bohol is surrounded by dangerous coral reefs which close the entrances of rivers and harbors to deep-draft boats.

The large municipalities are all on the coast, and the only communication between the municipalities on the west and north coast of Bohol with each other and the southern municipalities is by water, with no steamer service.

There are no pack animals or cart traffic to handle the supplies for public works, schools, or municipalities on this island, so a launch with regular trips with fixed passenger and cargo rates was decided upon as solving the transportation question.

To meet all the above conditions, a light-draft launch, fitted with a kerosene engine, with sail auxiliary, was ordered through the Bureau of Supply.

The hull was constructed in Hongkong and upon completion was shipped to the Bureau of Navigation in Manila where the engines were installed at a coast of ₱1,485.85 and the launch fitted for open-water work.

The dimensions of the constructed launch were as follows:

	Dimensions.	
	Meters.	*Feet.*
Length	15.24	50
Beam	3.66	12
Draft	1.67	5.5

The engine installation consisted of a 22-horsepower Meitz Weiss kerosene engine which develops a speed of 7 knots an hour with the launch light, and 6 knots an hour when fully loaded to its 25-ton capacity.

The principal equipment outside of engine tools consists of a 16-foot landing boat, a self-starter, and 14 life preservers.

The hull is entirely closed and can be made water-tight, which is a big factor in open-sea work. The cargo hold is forward and covered with a hatch, while the engine installation is aft and has plenty of ventilation.

The following table shows the various items which constitute the total cost of the launch:

Engine	₱2,640.00
Hull	6,132.97
Bringing launch from Manila to Bohol	180.00
Installation of engine	1,485.85
Total	10,438.82

The same size boat constructed in the Philippines with a lower cost of engine installation should reduce this price to ₱8,000.

The crew for running this launch take their instructions from the provincial treasurer direct and consist of—

1 Filipino patron	per month	₱70.00
1 Filipino engineer	do	60.00
1 Filipino assistant engineer	do	30.00
1 Filipino sailor	do	20.00
1 Filipino sailor	do	15.00

Subsistence is furnished the crew at a daily rate not to exceed ₱0.20 per member.

This launch has been in continuous service since July 13, 1910, and its work has been purely of a provincial character. The financial report of this service is herewith given:

Original cost of launch, including hull, customs duties on same, and installation of engine (if the hull had been constructed in the Philippines, the customs duties of 50 per cent ad valorem would have been saved)	₱10,438.82
Cost of equipment on launch (including self-starter, rowboat, life-preservers, and tools)	1,212.74
Cost of repairs and maintenance from July 13, 1910, to Dec. 31, 1912 (including installation of self-starter, resetting of engines, etc	1,877.50
Cost of operation from July 13, 1910, to Dec. 31, 1912	11,309.93
Total cost of launch and operation to Dec. 31, 1912	24,838.99
Revenue derived from July 13, 1910, to Dec. 31, 1912:	
Actual collections	14,317.08
Uncollected bills	113.09
Services for which bills have been rendered in January, 1913	980.00
Services rendered free of charge, such as delivery of relief rice, etc	800.00
Total revenues from launch	16,210.17

In other words, the launch has returned in two and a half years over 65 per cent of the total money invested in same, including its maintenance and operation.

The present value of the launch and its equipment is estimated at not less than ₱10,000, after making a reasonable deduction for deterioration.

Total cost of launch, etc., to date	₱24,838.99	
Actual gain to date	1,371.18	
Total		₱26,210.17
Revenue produced to date	16,210.17	
Present value of launch and equipment	10,000.00	
Total		26,210.17

The launch does not compete with any commercial boats. Only official freight and passengers have been carried, except in cases of emergency, when private cargo and passengers are taken on. If it had engaged in transporting private freight, the revenues would have been considerably larger.

The launch has on several occasions rendered services which could not be conveniently charged out, such as the distribution of several loads of relief rice, transportation of shipwrecked sailors, etc.

If the Province of Bohol owned a launch having double the carrying capacity of the launch *Bohol* and could engage in the transportation of private freight, there is no doubt that it would be a very good paying investment to the province.

Through the launch *Bohol* the carrying of the mails, the distribution of supplies for the province, the municipalities, schools, and public works, and the transportation of public officials have been greatly facilitated, thereby causing a great saving of public funds, besides being a source of great convenience and efficiency to the public service. Experience has demonstrated that it is very difficult to charter steamers at Cebu for the delivery of road and bridge materials in Bohol, and that such charter, when obtainable, is exceedingly costly.

The launch *Bohol* is insured with the Insular Government in the sum of ₱8,000, for which the province pays a yearly premium of 6 per cent, or ₱480.

PROCEEDINGS OF THE DISTRICT ENGINEERS' CONFERENCE, HELD AT MANILA, P. I., FEBRUARY 4-11, 1913.

Meeting called to order at 9 a. m., February 4, 1913, by Mr. E. J. Westerhouse, chief division engineer.

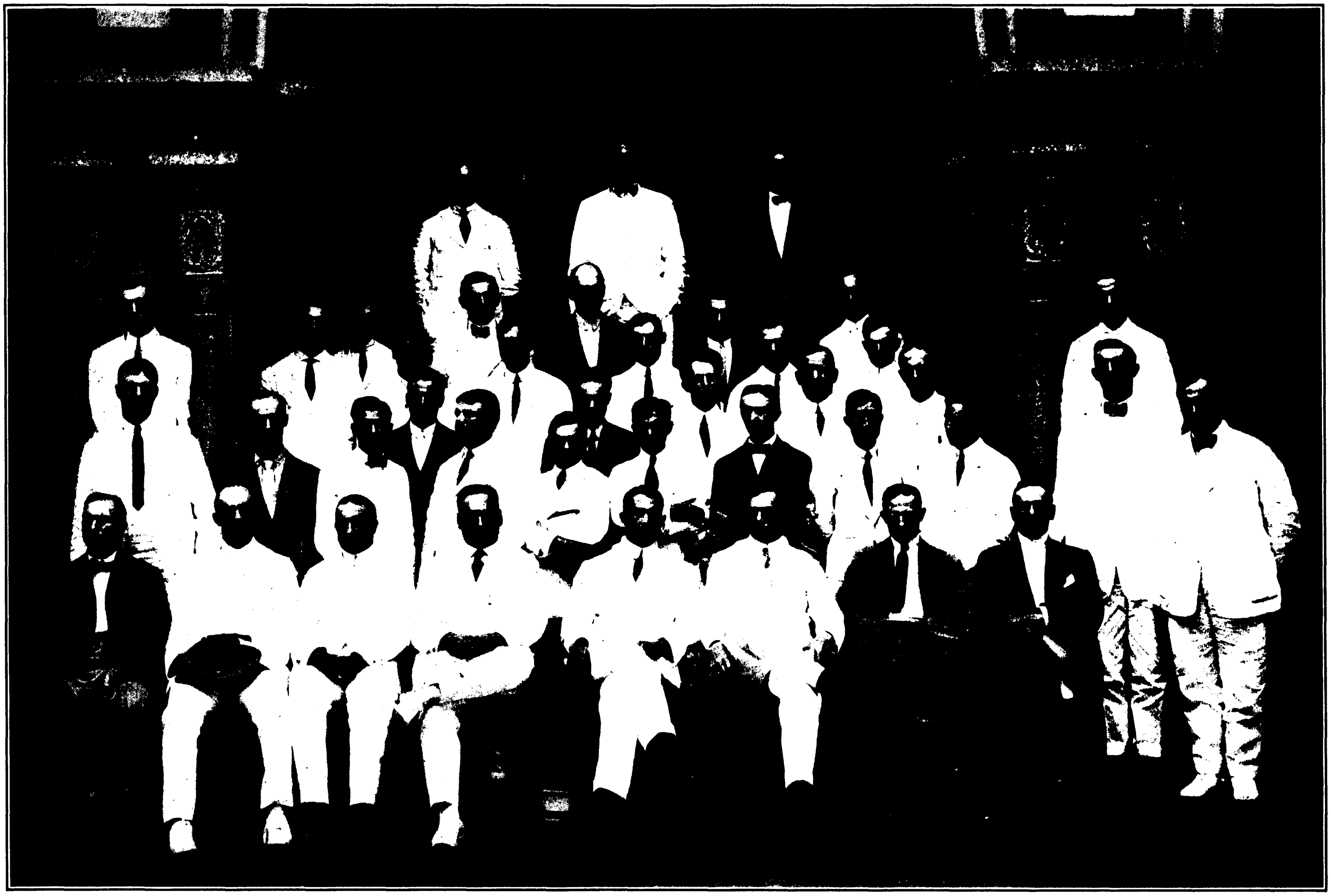
ADDRESS BY MR. WESTERHOUSE.

GENTLEMEN: This is an informal conference which has been called to bring all district engineers together for the purpose of considering a number of matters largely affecting Bureau policy. The meeting was made informal for reasons which were thought necessary. The orders directing you to report to Manila were, therefore, signed by the division engineers. Some comment has been made about the wording of those orders. I want to say that I take all responsibility for the wording thereof, and at the time thought that we were making them sufficiently strong that all district engineers would be here promptly at the hour indicated. I now find that such is not the case. However, those of you who came late will find that the order will be effective nevertheless. The same thing is going to be true of the program throughout; there can be only one excuse for paying the expenses and subsistence of engineers while attending this conference, that is their presence at all of the meetings at the place arranged, in order that they may get the full benefit thereof.

We believed this conference necessary, as we desired to give the engineers an opportunity to get together and give such expressions as they might desire on some of the shortcomings of the central office; also, that they might suggest any measures or means that could be adopted in the future which would increase the efficiency of the Bureau as a whole, and for the purpose of considering a number of matters which are exceedingly difficult to handle through correspondence.

The transaction of business through communications is unsatisfactory at its best. We have found that the engineers in the field often misconstrue communications, giving them the wrong interpretation, thereby embarrassing both the Bureau and the engineer concerned in the field. In this connection I recall, when a number of years ago orders were sent out transferring a certain district engineer, the entire transaction being in good faith insofar as the central office was concerned. The district engineer for various reasons construed it to mean a demotion or a reflection on his services and entered a vigorous protest. He finally closed with this statement: "The Director knows how deathly seasick I get every time I take a trip on the water and this transfer can be made for no other object than with the hope that when I get on the boat I may get so seasick that I will throw up my job."

Now, I want to say this: The present administration of the Bureau of Public Works will at all times be absolutely frank in all matters; there will be nothing concealed; no necessity for any attempt to read between the lines. If your services are not entirely satisfactory on any one point you will know about it and in very precise terms. Unless this appears explicitly, you may rest assured that whatever action is taken, it is not an indication that the Bureau is dissatisfied with your services; that the action is deemed necessary by reason of the exigencies of the service, and if not for the best interests of both parties concerned, that it is believed to be at least for the best interests of the Bureau itself. You can, therefore, accept everything at its face value.



Assistant to Director, C. Lindsey; Warwick Greene, Director; E. J. Westerhouse, Chief Division Engineer.

Division Engineers:

D. E. Henry. E. P. Shuman. H. F. Cameron. W. H. Waugh. B. Von Schmeling.

District Engineers (standing): L. W. Scheidemantel, J. W. Graham, S. Baluyot, E. D. Smith, L. S. Boggess, M. Kasilag, E. E. Schenk, J. Vallarta, R. Agcaoili, A. W. Austin, C. R. Bennett, W. F. Root, J. C. Carpenter, C. G. Morrison, R. L. Barry, J. R. Barry, R. W. Randolph, A. T. Sylvester, J. G. Beckjord, H. A. Raider, R. N. Allen, L. T Clark, E. C. Brown, O. N. Powell, R. V. Glenn, J. H. Caton, J. A. Harrison, H. R. Meehleib, W. C. West, C. F. Vance, R. A. White, H. K. Davis.

In presenting the Bureau's case this morning I am going to speak very frankly so that there will be no question left for doubt on any subject that is taken up. To begin with, you will all appreciate that one main essential is absolute loyalty on the part of every employee of the Bureau to its organization and its policies. When an employee feels that he cannot agree with the policy as outlined by the Bureau, if he has any criticism to make, that criticism should be made directly to the Bureau. Otherwise, his services are of little value to the Bureau and it is up to him to sever his connection with the Bureau. We must have absolute loyalty on the part of every engineer in the Bureau, especially the men in the field, because on your record and attitude the organization must prosper or fail.

There is another matter of utmost importance, this being that in your conversation and action you should never reflect on the work of your predecessor. This is a common occurrence and must necessarily result in embarrasment to the Bureau and can at no time result to the material credit of the engineer making the criticism. You should remember that such criticism involves the Bureau as a whole and action in matters of this nature should therefore be left with the Director. Such criticism on your part can just as well be made directly to your division engineer or, if believed desirable, in a confidential letter addressed to the central office. You will find times when it may prove highly embarrassing to avoid direct criticism. We don't expect you to cover things up; none of us are infallible; we will all make some mistakes. If local officials bring such matters to you in a way that you find it difficult to avoid an expression, it is best to pass it off with a general comment that men who do things—those who have to exercise their judgment—will make mistakes and that what the Bureau is striving to do is to profit by those mistakes, assuring them that the same mistakes will not recur.

It has also been observed that in case of a transfer or in taking over a new district, the tendency is, unconsciously, to display prejudices. Some of the older employees are discharged for what is believed to be in the best interests of the service. This is so general that is is up to every engineer to specially guard against such action as much as possible. I believe that you should give men under you in the district every chance to make good. The mere fact that the employee has made good with your predecessor should be entirely in his favor. This affects all classes of employees, even the camineros. The greatest success of this Bureau will necessarily lie in applying civil-service rules as much as possible in recognizing past services, overlooking shortcomings and mistakes, at least to a reasonable extent. Our strongest argument with those who legislate for the Philippine Islands lies in the fact that an employee generally becomes more valuable to the service through length of service. Unless we are consistent in following out this contention, we endanger the entire public works organization, including the engineers in the provinces, through legislation which may even result in rotation in office. This would eventually prove detrimental to the entire service, the class of work, its economical prosecution and the general policy of the Government.

Now, it is becoming more and more apparent that the success of this Bureau depends largely on the success of the men in the field—that is where the results are being accomplished. We must stand or fall by the results we get in the field. It must also be apparent that we are going to have more and more a representative form of government in the Philippine Islands. This will mean that the district engineer, besides having the qualifications of a high-class engineer, must possess executive ability, must be able to deal with his coworkers in the field, and must make a favorable impression on the local authorities. We now have a representative form of government in the Islands to such an extent that unless an engineer is able to accomplish results as I have outlined he will be of little value to the Bureau and will sooner or later very seriously embarrass the entire central organization.

We are practically now a Bureau entirely dependent on the good will of the people for whom the work is being accomplished—the taxpayers who send their representatives to legislate for them. This means that immediate efforts must be made to employ local labor wherever possible. Every possible effort must be made along this line. You will find it difficult to do this in the beginning. It will prove annoying in many cases; it will mean overwork on the part of the engineer and a large amount of your time will necessarily have to be spent in giving instruction. In the end, however, you will find it the most economical course, and that within a comparatively short period you will be able to get equally as good results as you are getting through adopting a line of least resistence in the employment of a class of labor which, although trained in a measure, is high priced and unreliable in that it is of a migratory nature. The Director of Public Works has considered this question very carefully. It is now practically one year since he gave considerable thought to the amplification of this policy. As early as March or April last year he framed a confidential letter which was sent to all district engineers some months later. Many of you, perhaps, have not had time to read this letter very carefully; you have, probably, not given it the consideration that the Director intended and which it deserves by reason of the thought and time he gave its preparation. I am going to read this letter to you; I am going to try and give it the expression that the Director intended:

I have the honor to invite your attention to an important phase of Bureau policy which has not received the consideration from district engineers that it demands. I have reference to the training of natives as reliable construction foremen. This is in accord with the general policy of the Government and requires your immediate attention.

It is essential to the economic administration of this Bureau that intelligent Filipinos be developed for positions such as maintenance foreman, overseer, building superintendent, inspector, and the like. These men should be intelligent, fairly well educated, and as far as possible men of standing and influence in their community. To get this class of men it will be necessary to pay a salary considerably in excess of what has been paid native employees customarily; but where this has been done, as it has been in a number of provinces, maintenance foremen and building inspectors have been developed who are accomplishing results satisfactory in every way.

(By WESTERHOUSE. Now, when the Director says "satisfactory in every way" he refers to his own observations and not as reported by the district engineer.)

Some difficulty will be encountered in developing a spirit of coöperation on the part of the nontechnical American employees, the tendency being to discourage native apprentices rather than to offer assistance in developing them along the lines desired.

(By WESTERHOUSE. We never expected any difficulty on the part of those with sufficient education in having them appreciate and understand the policy of the American Government in the Philippine Islands.)

This is a question of administration and you are expected to advise such employees that the value of their services to this Bureau depends largely on their success in developing natives for independent work.

(By WESTERHOUSE. We do not consider it up to the central office to direct the men in charge of work in the field to employ, discharge, or replace any one individual.)

Results along this line will be a factor also in the consideration of promotions for district engineers.

And I want to say that at least two promotions on the 1st of January were made on the strength of the showing made by the district engineer along this line.

This letter was then followed up with Provincial Division Circular No. 92 and the editorial in the January 1, 1913, issue of the QUARTERLY BULLETIN.

This question of policy is not new to the Philippine Islands. It was established with the beginning of the American Government in these Islands and so long as we serve under this Government it is going to be up to us to work in accord with this policy. The Bureau of Public Works, by nature of its duties, is in a position to be the most popular branch of the Government service. We can make it so absolutely through the employment of men with education, with good bearing, good judgment, men who will naturally be influential and make an impression on local officials and the people of the provinces with whom they deal. This result once accomplished will place the Bureau in a position where no legislative body, no set of officials in authority, will propose legislation or regulations which will prove detrimental to the Bureau organization and its engineering work.

In connection with this I also desire to call attention to the advisability of employing English-speaking Filipinos. English must unquestionably become the common language of these Islands. Any effort, therefore, made to train employees on public works who have made no effort to acquire the English language will in later years, in a large measure, prove a waste of time and energy. It is only a question of five, or possibly ten, years when the English-speaking Filipino is going to control, and employees trained for the district work not in accord with the views of the English-speaking Filipino public will be as fully out of place as some of our trained employees that we are relying on to-day. I have dwelt on this subject rather extensively because this one question of policy has affected the Bureau very seriously.

I want to suggest the importance of giving serious consideration to all orders which bear on questions of policy, types of construction, and the more important matters that, as a branch of the Government service, we have to contend with. You will recall the circular asking for a traffic census on all roads constructed or such roads as are likely to come up for construction, thereby giving the Bureau an opportunity to use these data as a justification for roads which have been constructed and as an argument on other projects in preferring one road location to another in our recommendations for those considered most important. This is exceedingly urgent and those who have not given this matter very careful consideration should immediately take the matter up on returning to their stations and give us all the data on all projects that may come up. This should include the total population of the localities traversed by the proposed road, a careful description of all the products of this locality, the class of traffic and type of transportation that may possibly be employed on the road when completed. On the roads already constructed we find that where data on the amount of traffic have been submitted we are able to absolutely justify 90 per cent of the kilometerage of road constructed and it furthermore shows such additional increase in traffic that it is permitting us to take the position, with those in higher authority, that all of our construction work should even be of a more substantial nature.

Referring to the type of construction we are employing at present, few of you appreciate the constant campaign that the central office is involved in in endeavoring to convince those in authority that the type of road we are at present constructing is justifiable. I dare to say that 50 per cent of the officials in authority have been contending that our road-construction work is entirely too elaborate; that traffic conditions do not demand this type of construction. Through the data which have been submitted by district engineers on the amount of traffic developed on first-class roads, we have now been able to make a very marked impression on those officials, and with the district engineers appreciating the value of these data—the principal purpose for which it is to be employed—I feel confident that within the next six months we will have sufficient data to convince all parties concerned that if the Bureau has erred, its error has been in not constructing along more substantial lines.

Another urgent matter is the necessity for securing a complete boring outfit for each district, a map-filing case, the inauguration of a uniform system of records, etc. You will readily appreciate the advantage of a uniform system of filing for office records, plans, etc., after you have been transferred from one district to another and have found it exceedingly difficult to find important correspondence of your predecessors, or where you are unable to find certain important drawings, field notes, plans, and investigations that have been made by your predecessor, entirely sufficient, but being unable to locate the data, you find it necessary to again accomplish the same amount of work, resulting in a direct financial loss to the Government.

One difficulty encountered, which affects the central office as well as the districts, is the tendency to avoid pointing out relevant and material details. Engineers should first of all, in submitting information of any kind or description, make sure that all of the information that the report is based on has been carefully considered. It is exceedingly dangerous to take anything for granted. I have found myself in an embarrassing position on several occasions through insufficient research, taking such data as were most readily available and basing my report and recommendations on such information. Where this is done, it will always come back to you sooner or later; it never fails. The division engineer is absolutely dependent on your recommendations—on your own statement of facts, as you have gathered them from the information locally available. The chief division engineer, in turn, is largely dependent on this information as indorsed by the division engineer. The Director of Public Works in such cases relies entirely on the chief division engineer's findings. When such report or recommendation is given out and is found defective, higher authority holds the Director of Public Works responsible. The Director can only officially acknowledge such responsibility and answer by stating that the necessary disciplinary measures have been applied. At times, then, it can be traced entirely back to the district engineer. You will see, therefore, how such matters involve every member of this Bureau, including the Director.

In addition to lack of information there have been many cases where specific information was not requested on any one particular point; a point, however, which the district engineer knew at the time was vital to the question, but which he concealed and avoided by reason of the fact that it had not been expressly indicated. Along this line I recall, a number of years ago, where a district engineer in constructing a steel superstructure had two employees injured on the work. The provincial governor immediately telegraphed the Executive Secretary pointing out the fact that the district engineer was incompetent, demanding his removal for having allowed two of his constituents to become seriously injured on the work. This was indorsed to the district engineer for explanation and a statement of all the details in connection with the accident. The district engineer came back stating that these men were not in the service at the time they were injured. This went back to the Executive Secretary with an indorsement and in turn to the provincial governor. After going through all the various departments it finally came back with the seventeenth indorsement, as I recall it, with a large number of affidavits attached stating that these men were at the time employed on the erection of the steel superstructure; that they were injured while in the service, and the evidence appeared entirely conclusive. It was again indorsed back to the district engineer with this result. He explained that these men were previously employed on the erection of the superstructure; that he was there at the time and as they started to fall he immediately discharged them; consequently, when they received their injuries they were no longer in the service. We do not have many cases as absurd as this one, but we do find cases where we have to continue to indorse papers back and forth where new matter has been indicated through agencies of other branches of the Government service.

Another thing of importance is that district engineers should recognize the necessity for taking immediate action in case of calamities, whether they affect public works or not. The Bureau naturally desires recognition of services rendered by district engineers in such cases. I have always found that district engineers have done their share of the work; they are not good publicists, however, and do not get the credit they deserve. This matter can be improved on by prompt telegraphic report to this Bureau of damages suffered by any of the public works in the province. Now, you may find that public works have suffered practically no damage. Such information should be promptly submitted, being equally important as information that certain public works have suffered. A special effort should be made to get this information to the Bureau with the least possible delay. You may rest assured that your efforts will be specially appreciated if it gets to this Bureau ahead of similar information sent in to other Bureaus through their representatives. Where public works are damaged it is always important to know (1) the amount of damage as based on the valuation, and (2) the estimated cost to reconstruct or repair in a manner which will prove substantial, possibly involving at times a larger structure. It may involve, in the case of a road, an artificial binder where the overflow sections are affected, or other types of construction which this flood demonstrates a necessity for. In the majority of cases information that has come in has been based on the cost to reconstruct a much larger structure or extending the structure in lieu of an approach fill, or the reconstruction of a road which had not been entirely standard, but to be reconstructed with an approved cross-section. The result being that this information is entirely misleading and is usually given with the hope of securing a maximum amount of relief funds or special allotment. The method only results in embarrassment to the Bureau and can be of no avail, because in no case will allotments be made, either as special allotments or as relief funds, without thorough and complete investigation, by the division engineer, if necessary, and the amount of funds that the district will secure, therefore, will not be influenced by the first telegraphic report. There is no objection to giving this information, but it should be given in connection with the more important information of actual damages based on the original value of the work in place.

In submitting project notes for the BULLETIN we are largely dependent on the interest shown by the district engineers. The object of publishing the Bureau BULLETIN is largely in the interest of the people in the provinces. I think you will find that the officials of the various provinces are largely interested in what other provinces are doing, what is being accomplished in other districts, and the project-note feature, I believe, will appeal to them more than any other part of the publication. We, therefore, desire to enlarge on this feature as much as possible. District engineers should submit these reports independently of the division engineers with the expectation that the division engineers will make observations on certain features pertaining especially to the locality and which the district engineers of that particular district accepts as a matter of fact and assumes is general throughout the provinces. That feature of it we desire the division engineers to cover. All notes of details as to difficulties encountered in construction, itemized cost, the population and products of the locality benefited through the construction of the road project, its relationship to other projects, etc., we expect to get from the district engineers. There is no objection to submitting an article on the same project provided the matter is somewhat foreign to the notes submitted previously. To avoid repetition, I would advise district engineers in all cases, when submitting their project notes, if there is any question about the notes having been previously submitted on the same subject, to consult all previous BULLETINS to avoid not only repetition but also to be consistent. If the cost of a bridge has been reported, or approximated, at ₱21,000 and three months later the project is entirely complete and through cross entries or a readjustment of the treasurer's books or through extras required or an adjudication of any claims the contractor may have had, the cost of that structure finally runs up to ₱23,000, this should be stated, but the apparent discrepancies should be made entirely clear through giving the reasons for the differences between the two amounts reported.

I want to offer another suggestion. It has been observed that in many of the provinces it is exceedingly difficult to secure clerical help, I might say at any rate of compensation, really capable of transacting the office affairs. One of the most essential things is that the district engineer should spend the greater part of his time in the field. Now, if by reason of Bureau regulations this condition does not exist, it is up to you in this conference to clearly make this statement and definitely indicate what part of such regulations may be modified, what work may be eliminated, what is now required of district engineers in the way of reports, etc., for which value is not received so that the central office may take action along this line. I want to caution you, however, not to deal in generalities. It is absolutely essential that you be explicit, with a definite remedy in each case, and, if submitted along these lines, it will not only be appreciated by the Director, but I can assure you that action will be taken with very little delay. You are at liberty to criticise, condemn, and recommend anything pertaining to Bureau policy that you see fit, so long as it is addressed to this Bureau. Aside from this, many of you find it necessary to spend a large portion of your time in the office looking after work which the clerical force of your office should handle absolutely and accept full responsibility for. This Bureau is rarely in a position to supply clerks capable of the development necessary to meet those conditions. We will gladly do so at all times where it is within our power. As a general proposition, however, we are compelled to look to the district engineer to locate this class of material within his own district. For this purpose one strong district clerk is required. We are ready at any time to take a definite stand on the amount of compensation it is necessary to pay such employees in order to secure their services. There has been no limit placed and the only precaution that we ask is that the district engineer make every effort to secure the best material available and be sure on one point, that other officials who are in a position to comment on the value of such services will not be able to state that certain other eligibles are available with equal ability to fill the position at a lower rate of compensation. In many of the districts I believe that this organization is as complete as we can hope for, considering the conditions in the Islands under which we are obliged to work. There are a number of districts, however, where the district engineer is in reality spending a large part of his time in the office with insufficient material to develop and, therefore, all of his efforts are futile. The only way to meet these conditions is to secure a clerk that is capable of development and then divert the time necessary to instructing him with a view to bringing about the conditions desired. In order to be absolutely sure in this matter it will be necessary for the district engineer to definitely fix the responsibility for the entire administration of his office on the district clerk or divide the responsibility along definite lines so there can be no question as to responsibility should complications arise at any time either in the matter of finances or routine work. I have known of some cases where the district engineer set aside certain days with specified hours for instruction on office administration. That, of course, is up to the district engineer himself. I would suggest, however, that on returning to your district that at least one conference be called advising the assistant engineers of the policy as outlined by the Bureau in this conference (few assistant engineers having had an opportunity to attend this conference), and taking up with them the various other matters which have been mentioned, thereby giving them the full benefit of the information and experience you have gathered while attending this conference.

There are several features that I would like the conference to take up especially. One is a free discussion on the condition under which the collapsible deck type of bridge may be used, this being an experiment that the Bureau undertook a little more than a year ago; the difficulties that may be encountered in employing this type of bridge under the various conditions, the method of construction, etc. There are district engineers and division engineers present who are absolutely familiar with the details connected with this type of construction so that, I believe, the thing can be gone into so thoroughly that no mistakes need be made in employing this type of bridge for localities unsuited to its use or in constructing the bridge in a manner which will prove defective or inadequate. Also an expression and discussion on the wording of the Bureau of Audits Circular No. 256; an expression on the value of reporting present condition of roads as they are now reported in the shape of the road diagram as against the previous method of submitting such reports; some expression on the advisability of continuing the quarterly publication which we are now turning out in the shape of a bulletin and the manner in which it may be improved.

In closing, I want to say that the Bureau has the reputation generally of being the one Bureau that stands together; that works like a machine; that the men of this Bureau make it a special point to defend each other and that they are loyal to the Bureau as an organization. This expression comes to us from the provinces through many sources and is the source of much gratification especially to the Director. The Bureau also has the reputation of accomplishing results—permanent results with the least amount of failures consistent with economical construction. This reputation is not only confined to the jurisdiction of the Philippine Islands, but it has come to us from other sources in the States and countries in the East. I feel that credit for this is due entirely to the men in the field for the way in which you have prosecuted the work and have carried out the plans and policies of the central office. This is all I have to say this morning. I thank you.

Address by Mr. C. W. Keith.

GENTLEMEN: Mr. Westerhouse proposed that I address you, but after his remarkable speech I feel there is very little I can say that would interest you.

However, we have had quite a little trouble in securing sufficient data for designing bridge structures which require no changes in plans after they have been received by the district engineer, or no changes during the course of construction. In 99 cases out of every 100 we find that some data which the district engineer should have furnished were missing. The most important data that have been lacking in the past are those on soundings. I understand that the provincial division has now arranged for every district to have at least one sounding outfit, and it is hoped that hereafter, when you tell us that you have clay for foundations, there will be clay; when you say coral, there will be coral and not light shell. On many occasions I have noticed that soundings show blue clay, but after we had designed the structure without pile foundations it was learned that the "blue clay" was "blue mud" and consequently we have had one or two failures because the district engineer, instead of reporting the changed conditions and requesting a change in foundation plans, went ahead with the construction as originally planned as if to say: "Well, that is the plan that Keith sent out to us; we have no business to change it." When the data on which the structure has been designed have been found to be different from those encountered during the course of construction, it is always up to the district engineer to report it, and, if there is sufficient time, a new design would be prepared; or, if there is not sufficient time for this, the division engineer should be called on, and, in extreme cases, when neither of the above can be done, he should use his engineering skill and ability to make the structure safe.

In making your recommendation as to the type of structure, always consider the nature of the stream, whether or not there is any drift and the amount of same, the danger of scour, and in considering whether there is danger of scour remember that while the stream is unobstructed it may show no indications of scouring action, but just as soon as piers or pile bents are in place conditions might change considerably.

One great kick I have with district engineers is in regard to their not following instructions in the matter of reporting to this office whether or not a bridge has been constructed in accordance with the plans. We have to assume that it has been, while it is probable that at least 10 to 15 per cent of them have had changes made. Something like two years ago a letter was sent out asking all district engineers to keep on file a plan on which they should indicate what changes were made and on the completion of the structure to submit the plan to this office in order that our records might be kept correctly. In this way, when an accident or failure happens, we can look to our plan and arrive at a more correct conclusion as to the cause of the accident or failure.

In the construction of reinforced concrete pile bridges—something new—there have been practically no instructions given as to the data that ought to be sent to this office for our records. We indicate on the plans the probable length of piles to be used, but we do not expect you to always drive that length; it might be longer or shorter, but we want to know the length of every pile put in—that is, we want to know where the pile point is; we also want to know in case you use longer piles. We had an occasion, not two years ago, where the stream began to scour. We tried to find out the depths to which the piles had been driven. There was no record, and we did not know whether the pile was 1 foot or 10 feet in the ground. Where concrete piles are driven and as soon as possible after the structure has been completed, please furnish us with a pile record showing the location and length of pile and the bearing value of each pile as determined by the formula given in the specifications.

Another objection that we find is that we get very little criticism on our estimates. We depend entirely on the dictrict engineers to furnish accurate information on which to base the unit prices used in preparing our estimates of cost. I assure you that in case the district engineer does not criticize the estimate of cost as being too low and it is found after advertising that no contractor is willing to do the work within an amount 5 per cent above estimate, the final recommendation will be that the district engineer be compelled to build the structure by administration. In that way only will we be able to meet the objections of contractors regarding the Bureau's making low estimates, expecting them (contractors) to take the work at a price which allows them too small a margin of profit. If we can do the work within the stipulated amount they, too, should be able to do it within the same amount.

In regard to collapsible deck bridges of which Mr. Westerhouse has spoken. I do not know whether I should say anything about them or not. I suppose the man in the field knows more about how bridges are going to act than I do. The drift-carrying elevation of the water is the important item. Where pile bents are used, when the heavy drift starts it piles up and naturally scours or probably breaks the bents. It is important that reliable data be obtained before the bridge is constructed. As to the necessary height of the road, I have heard one or two remarks about what was the use of putting the bridge so low. I had occasion not very long ago to see a collapsible bridge being constructed where the length of the structure was materially shorter than the width of the river. The bridge was put up so that it could be used when the water became a meter or two above low water. I observed that a man could not get to the bridge when the water was that high and I suggested that they bring it down, which they did. The height of the bridge should not be above that of the elevation of water pass; or, if there are no automobiles in the district, through which a wagon could pass. In order that we may have a record of the structure as built, we ask that whenever these bridges are built that the district engineer furnish us with a general plan of same and a general statement of the kinds of wood used and the cost of the bridge complete. Timber piles used in collapsible bridges should be of durable wood, otherwise we get little benefit from these bridges. I do not believe any but first or second group timber should be used. Less durable timber does not drive well, dry-rots, and will not stand heavy currents.

We have been called upon on several occasions by contractors coming into Manila stating that they did not find conditions as were indicated on the plans: that they would go out and find materials such as sand and gravel which they were given to understand could be used, but were later informed that such materials were inferior and would not be allowed in the work. They also have asked us what kind of a road we have to get to the bridge. In only a few of these instances have we been able to furnish this information. This condition of affairs should be remedied by the district engineers furnishing accurate and complete information in all cases. I think some of this trouble is due to district engineers transfering to other districts and not leaving their records in such shape that this information could be readily obtained by the successor. But let me impress upon you, if I can, the necessity of furnishing the bridge division with accurate and complete data; and if we do not ask for as much information regarding the location and conditions as you think we ought to know, furnish it anyhow. We are always glad to get all available information. Remember that the man who designs a structure does not necessarily ever see the location, and the information you furnish is all that he has on which to base his design. If it becomes necessary to alter the plans you should immediately notify us in order that such changes may be made and new or revised plans furnished you.

We are always glad to receive comments and criticism on all designs. While we appreciate the fact that we are not infallible and some times make mistakes, we know that some of these mistakes are found after the plans have left the office and in a great many cases we do not hear of them until the contractor finds them. We would like the district engineer to find them and tell us before the other man does.

We are now starting out to build standard markets and tiendas. This work is something new to us and we look to every district engineer who is now constructing markets or who contemplates the construction of markets and tiendas to comment on the plans furnished him, showing us where we can improve upon them and where we can cheapen the construction without reducing the strength or mar their appearance, although the matter of appearance is one that we have to take up with the Consulting Architect. At the same time I would like to know where the designs can be improved upon, and any suggestions along these lines will be appreciated and given due consideration.

In the afternoon a joint conference with the division superintendents of the Bureau of Education was held at the Normal School Building for the purpose of considering matters of mutual interest.

Conference reconvened and called to order by Mr. E. P. Shuman, division engineer, Wednesday, February 5, at 8 a. m.

Mr. HENRY. There is one subject that the chief division engineer has requested me to bring up in this meeting and that is the availability, quality, and quantity of sand and gravel in each province. I shall read a letter which you may discuss and decide upon the procedure to be taken:

> I have the honor to suggest that district engineers be required to submit samples of sand found locally in their respective provinces, for the purpose of testing its fitness in concrete work.
>
> It is suggested that when these samples are sent in, a quantity of sand from which the sample is taken be kept in the office of the district engineer marked as to locality and numbered same as the sample and when results of tests are forwarded the entire data be marked on receptacle corresponding in district office.
>
> By having this sample in the district office, it is thought that comparisons can be made between samples taken in the field and the office samples at any time, and minimize the possibility of using an inferior grade of sand. I understand the Bureau of Science will arrange for these tests; but it will be necessary to expedite action of district engineers in order to warrant arrangement of force by Bureau of Science.

Mr. Reibling of the Bureau of Science is very much interested in this matter. It is being taken up in the States and a more complete set of tests are being gotten out. Sand is being given a larger consideration now than it was a few years ago. They consider that sand deserves a more important place in concrete than has been given it before.

Mr. CATON. In regard to this matter—sand being given more attention now than at any other time—I have a case in mind. The designing engineer of a certain project said that the sand was good and needed no test. Practically 200 cubic yards of sand had been taken out before the engineer was prevailed upon to make a test. They finally made a test and it tested 53 per cent. They immediately rejected the sand and opened a quarry, crushed stone and made their own sand and it is interesting to note that the crushed-stone sand tested 93 per cent. We had to pay for the 200 cubic yards of sand extra.

Mr. SHUMAN. Has anyone anything to say in regard to district engineers arranging to keep a record of these tests of sand and samples in the different provinces?

Mr. VON SCHMELING. I believe in this line it is interesting only for the larger structures, such as special bridges, buildings, etc. When the bridge data are submitted, a sample of the sand to be used in the structure could be sent in at the same time and in that way the bridge division could be kept in touch with the quality of the material to be used. On large structures where it is a question of using one or another class of sand I suggest that one or two samples of the sand available be submitted at the same time that the bridge data are.

Mr. HENRY. This is just the point I am trying to make—minimize the amount of work, the probability of using an inferior grade of sand. I intend to try and make less work. It is to get on record the locality where the sand may be had at the time the test is made; have samples in your office; the tests recorded on your receptacle. If you have these records and some structure is to be erected you can take a sample of the sand to be used in the structure and compare it with the samples of sand in your office and not send same to the Bureau of Science, and ordinarily you will get good results. I believe that would be the easiest way to get around this question of sand.

Mr. VON SCHMELING. We are doing so much concrete work that it is practically useless to try and send samples of sand to be used in culverts and small bridges. The district engineer ought to be able to make his tests for smaller structures. For large structures the question of preferring one class of sand or another, I think, it would be best to send samples. I cannot see how comparisons could well be made by having one sample of sand to compare with another.

Mr. SHUMAN. Is it the opinion of the meeting that the district engineers should make tests of sand and keep these records of test in the office, or send them in and have the Bureau of Science make the tests and keep the samples on file in their office and a record of tests that have been made? I believe the district engineers are not doing this at present.

Mr. CLARK. A drawback to Mr. Henry's plan which makes me favor the argument of Mr. Von Schmeling is that in the course of the service transfers are necessary from time to time and even with the best office records, which may not in all cases be kept, a new engineer coming in would not get the full benefit of the tests. If he is not fully familiar with the samples it is quite possible that in some cases it would be impossible to accurately describe the situation under which the sand was taken. This is especially true of the conditions in some of the provinces where the sand has to be taken from small beds of a number of different streams.

Mr. AUSTIN. In my opinion it ought to be left to the district and division engineers. I think it should be left entirely to the district and division engineer, simply from the fact that we have not a single sand deposit that does not change its formation or location to a more or less extent every year, and if we test this sand this year, after a high-water period the condition of the sand changes and a test from the Bureau of Science would be useless and I actually believe that the only way is for the district and division engineer to determine for themselves whether the sand is worthy of use or not.

Motion by Mr. Cameron:

That as the testing of materials is recognized as important and as it is important to fix the responsibility for failure of bad material and as there are standard specifications for all materials, I move that it be recommended to the Director that he form a committee to name the materials of construction that go into the Philippine constructions and that said committee be empowered to determine what part of the specifications are applicable here and what part of the test is for the responsibility of the district engineer and what to the Bureau of Science. That a copy of said recommendations, including the standard test, be sent to all district engineers for comment and that final recommendation to the Director of Public Works be made from the results of said joint work of committee and the district engineers for his approval.

Seconded by Mr. Henry.

Carried.

Motion by Mr. Schmeling:

That samples of sand and gravel for such structures as in the discretion of the district and division engineer are considered of sufficient importance be submitted by the district engineers with the data sheets and full description as to the locality from which the sand or gravel is taken and what kind of water is going to be used for the structure. That the Bureau of Science furnish each district engineer with their publication on qualities of sand and the effect of sand on concrete structures.

Seconded by Mr. West.

Carried.

Mr. **Von Schmeling**. In regard to foundations. At present the Bureau of Public Works is procuring new sounding outfits and I have already heard some complaints as to their efficiency and the bridge division is requesting to know whether or not the sounding outfits are large enough. Some of you have already made soundings with these new sounding outfits and I want some of you to give your experiences as to their efficiency. It is Mr. Westerhouse's desire to make these standard and efficient and if there are any complaints let us bring them out so that we can get the sounding outfits in proper shape.

Mr. **Powell**. I have been making an investigation for a bridge, an old bridge with wooden trusses, and we want to find if the abutments can be used for a new structure, and to do that Mr. Keith wanted borings. In some ways the new boring outfit which I have been using is very satisfactory and in other ways it is not.

In the beginning we used a tripod of bamboo, but as to the question of making the size of the pipe larger, I don't believe we can unless we have some heavy hammer to drive it with. I have found that when the pipe was down about 6 meters it was almost impossible to drive it with a sledge hammer.

The augur works very satisfactorily in clay. It goes down rapidly and brings up the material in good shape.

The sand augur is rather inefficient. When we first tried it, we used a long pipe. We generally strike water about 3 meters below the surface, and on going down to about 7 meters we had a 4-meter head of water and in lifting up the augur all the sand washed out. The bailer is too small.

One disadvantage of having a large pipe is that it clogs very readily and does not bring up any material. I found that in driving through rock you cannot clean out the hole only with a jet.

The hand drill is too long.

The chain that was furnished is about 3 meters long and you can hardly wrap it around the pipe and put it over a lever and pull it up.

The bits, I think, are too small. The churn bits, after running the pipe down—the coupling has a 1-inch pipe—will not go through the hole that is made by the bit.

Mr. Bennett recommends the addition of one jet to this rig.

Mr. Von Schmeling moved that a committee be appointed to decide as to what changes should be made to the sounding outfit. The different matters suggested are a longer chain, additional hammer, a jet to raise the casing, a bigger bailer, and that the churn bits be provided with outlets for water. Also that the committee investigate the matter of going through quicksand with the sounding outfit and making the churn bits a little wider. That the committee report to the chief division engineer and these recommendations be submitted to the district engineers for comment.

Moved and seconded.

Carried.

Committee: Von Schmeling, Powell and Bennett.

Mr. Von Schmeling. Reduction of office work of the district engineer.

I know that in many cases the district engineer is doing too much office work and Mr. Westerhouse said yesterday that it was up to the district engineer to make suggestions, concrete and specific, as to the manner in which this office work could be reduced without reducing the efficiency, and I am quite sure that some of the district engineers will be able to make suggestions along the line of reducing this work, thereby giving more time for field work.

Mr. Carpenter recommends that Form No. 195 be eliminated.

Mr. Austin recommends that Forms Nos. 152, 191, 192, 193, 194, and 195 be abolished.

Mr. Libby recommends the abolishment of Form No. 195.

Mr. Austin moves that a committee of five be appointed to take up the question of reducing the office work of the district engineer and recommends that they be instructed to take up the advisability especially of abolishing Forms Nos. 152, 191, 192, 193, 194, and 195.

Seconded by Mr. West.

Carried.

Committee: West, Carpenter, Libby, J. R. Barry, and Sylvester.

Mr. **Carpenter**. We have four forms of instructions: General orders, special orders, provincial division circulars, and accounting division circulars. I recommend that a uniform-sized sheet be used in sending out all of these forms so they can be filed in a book presenting an even appearance.

Mr. Libby recommends that Bureau of Audits Circular No. 256 be abolished, although, he states, it is the only hold they have on the provincial treasurer in regard to what projects certain expenses and vouchers should be charged, etc.

Mr. **Raider**. The Bureau of Public Works cannot hold the district engineer responsible for overdrafts if Circular No. 256 is withdrawn.

Mr. **Austin**. I move that this matter of Circular No. 256 be referred to the committee on investigation of the reduction of the office work of the district engineer for comment and report as to whether it should be changed or abolished.

Seconded by Von Schmeling.

Carried.

Conference adjourned at 11.45 a. m.

An automobile inspection trip was made on Thursday, February 6, over the Manila-South Road and various construction projects along the route, leaving Manila at 7 a. m. and returning at 6 p. m.

Friday, February 7, 1913.

In the forenoon an inspection was made of market and school building projects in the Bulacan district. In the afternoon an inspection was made of building work in the city of Manila, including the Bureau of Supply bodegas, University Hall, and similar projects. Building foundations, waterproofing, and galvanized-iron roofing received special consideration.

Meeting called to order by Mr. E. P. Shuman at 8 a. m., Saturday, February 8, 1913.

Mr. **Caton**. In regard to the matter of placing picks, shovels, rakes, etc., on the expendable list. As a matter of fact, the auditing department is at a place where they do not know where they stand; if this conference sees fit to unanimously adopt a resolution stating that they desire these things put on the expendable list, they can make it stick.

The reason for this is that when we issue small tools they often go to irresponsible parties—practically never to bonded men—usually to camineros, etc. This makes it necessary for us to spend some part of our time in checking property and always necessitates a property clerk who does practically nothing but attend to property.

Another point in issuing small tools, if a memorandum receipt is issued in order to keep track of them, they have to be brought back to headquarters before they can be reissued. This, of course, necessitates delay and unnecessary expense.

On the whole, if the engineers have had any trouble in keeping track of small tools, I think we had better thoroughly discuss this matter, and, if possible, pass a resolution requesting that these tools be placed on the expendable list; also, definitely specify the names of the tools.

Mr. **Vance**. I remember an order issued by the Bureau in regard to depreciation charge made on small tools on maintenance work. I do not know what the practice is in other provinces, but in Samar there is no charge of tools against maintenance; all tools are purchased from equipment funds. My way of looking at the matter is when maintenance is started on a road the camineros are equipped with tools—shovels, rakes, wheelbarrows, etc.—that should become expendable and not carried as equipment. There is no first charge made on the amount of equipment that is furnished on a road. It seems to me that wear and tear and use of tools is just as much a part of the maintenance as the pay of the camineros.

When tools become worn out we must condemn them, etc., make a list of the condemned property, notify our district auditor, and he condemns the property or not; it may be a year before he gets around. When the old tools are laid aside they are very prone to disappear and after notification, if a man is to be held responsible for them, there should be some time limit for the inspector to condemn the tools. You all know, I guess, that when tools are broken and laid aside for condemnation, they disappear and you are short through no fault of your own. I think there should be some limit placed on the time for inspection after due notice and if the property is not condemned in that time the responsible party is relieved.

Mr. VON SCHMELING. In regard to the matter of not carrying small tools, shovels, picks, rakes, etc., on the nonexpendable property list. The reason for making a charge for such property as rope and rubber hose is that they wear out in use; they remain in the service for only a certain period. They are entered on the expendable property list and the Auditor requires only a certificate from the district engineer that this property was worn out and that it had been in use for a certain period.

If we turn property over to irresponsible parties, we lay a great deal of stress on taking care of same. We are naturally losing through theft, etc., but if it were nonexpendable property I think the loss would be much greater.

New tools chargeable to maintenance, I believe this can be arranged between the district engineer and the provincial treasurer. Without a doubt tools that are only used on certain projects should be charged to such projects. They should be purchased out of equipment funds but when turned over to a certain project they should be charged to that project.

Mr. HARRISON. I would like to suggest that it might be possible to persuade the auditor to allow a certain percentage of loss for small tools, based somewhat on time in use and somewhat on their value.

Mr. HENRY. I suppose that the argument along these lines includes all kinds of property and in order to get this thing in shape, I suggest that a committee of five be appointed to report on Tuesday morning and submit recommendations.

Seconded by Vance.

Carried.

Committee: West, Caton, Smith, Harrison, and Vance.

Mr. HENRY. It seems to me that it would be well for this committee to be careful about recommending their procedure in getting rid of expendable property upon the certificate of the district engineer.

Mr. CLARK. In regard to Provincial Form No. 38–A. The district engineer has to certify that the attached payrolls are "correct and just." The law is very stringent on this point and it looks to me that they are trying to make the district engineer responsible for too much. I suggest that the words "to the best of my knowledge and belief" be inserted.

Also in regard to the combination of payroll and time book, I would suggest that it would be better to have them made in triplicate instead of duplicate.

Mr. VON SCHMELING. I would like to ask the district engineers to express their opinion on this question.

Mr. WEST. We have had considerable trouble with time books and payrolls. They are worth nothing as they are not a record of original entry.

Mr. GRAHAM. I have found that the new time books are the best thing the Auditor has gotten out. The only difficulty we have discovered is that the timekeepers are inclined to make mistakes in filling out the total columns, but, of course, this can be overcome through employing a better grade of timekeepers.

Mr. HARRISON. We have had little difficulty with the time books. Mr. Dexter made a suggestion which has proved to be very valuable. The greatest objection seemed to be in carrying the book by capatazes and camineros who ride or walk over long distances every day. A time book weighs 2 or 3 pounds and, if they carry it, it is a real hindrance to their work. Mr. Dexter suggested that where a man is in control of 12 or 15 men there is no need in carrying the book in the field; that his memory was adequate to answer all purposes and that it would be possible for him, when he returned to his station, to make the necessary entries. Ordinarily a capataz has no more than 12 or 15 men and he can remember their names when he returns in the evening and we have allowed him to make entries at noon and evening. The result has been entirely satisfactory; the time book becomes absolutely a book of original entries. We have adopted the system of tearing out the duplicate and keeping that in the office so we have no duplicates in the time book.

Mr. DAVIS. The new system does not prevent foremen or capataces from being dishonest any more than the other one did, but it will enable us to get after the dishonest party.

Mr. VANCE. I think the form is a good one, but it is a matter for each district engineer to thrash out in his own district as to the manner of its use.

Mr. BENNETT. I suggest that the time book be allowed to stand as it is at present.

Mr. WEST. Except that the duplicate be perforated and that absolutely no instructions be printed on the books.

Mr. RAIDER. I concur in the suggestion.

Mr. DAVIS. I suggest that the words "to the best of my knowledge and belief" be inserted on the form.

Mr. CLARK. I concur.

Mr. SYLVESTER. I move that the resolution be referred to a committee appointed by the chairman.

No second.

Mr. HARRISON. I move that the matter be left to the committee on payrolls and that they define such a system as will cover this matter; that instructions be given to district engineers and provincial treasurers for the drawing up of instructions as to what rules will prove most feasible.

Seconded by Mr. Vance.

Carried.

Committee: Austin, Boggess, Kasilag, Beckjord, and Allen.

Mr. AGCAOILI. I would like to ask if there are any rules with regard to relations between the district engineer and the provincial board. In some provinces the provincial board is inclined to direct the district engineer and if that is the case the district engineer will have two "masters." If we are to be under the orders of the provincial board we should know it.

Mr. AUSTIN. Act 1401 clearly defines this matter. The district engineer is under no orders of the provincial board, only those of the Director of Public Works.

Mr. CAMERON. I have had the privilege of reading a proposed Act that is at present before the Legislature. This Act, if passed, will authorize provincial boards to break contracts, and also to discharge you at the end of the two-year contract. Also, the Act empowers the provincial board to reduce salaries at any time they see fit. It also empowers them to hold engineers personally liable for failures in the provinces, as engineers are to be bonded for same. These are all vital matters to each engineer.

Mr. AUSTIN. In my opinion this is not a question for us to discuss, but the question brought up by Mr. Agcaoili is of vital importance to each district engineer. I have had experience in some cases myself where the provincial board are inclined to be dictatorial to the district engineers and in most cases it has been to the detriment of the province, but my experience always has been that in case I get a direct request from the provincial board to perform a certain piece of work, I simply indorse it to the Director of Public Works. I think the most feasible way is to adapt yourself to the conditions and try to have enough influence with the provincial board so they won't want to give you orders.

Mr. HARRISON. I believe that in some cases a great deal more friction is caused than is necessary; that is the absolute refusal of district engineers to deal with certain classes of projects. I suppose all district engineers have had projects voted by the provincial board without even a suggestion on their part where the project is not only unfeasible, but where the funds available are entirely inadequate, and that very frequently they have simply tabled the resolution and neither said anything to the provincial board nor taken any action toward bringing it to a completion. A great deal of friction could be eliminated if the engineer would go to the members of the board and explain to them the reason why a project of that kind was not feasible.

Mr. **AGCAOILI**. The trouble is that the provincial board does not know whether the district engineer is under their direction or not and some members of the board, especially the new ones, are always under the impression that everyone in the province is under their direct orders.

Mr. **WEST**. It seems to me that we should be able to find the legal duties and responsibilities of district engineers and their relations and responsibilities with the provincial board pretty clearly defined in the Provincial Government Act, of which every district engineer has a copy.

Mr. **AUSTIN**. Another thing affecting Bureau policy is the question of training native employees to be capable of holding such positions as foremen, inspectors, overseers, etc. I believe one of our engineers has told us that he has been exceedingly successful and finds it economical to use native foremen instead of American foremen. There also seems to be a certain amount of misunderstanding, as I have seen it in the provinces for the past twelve years, by certain men being unable to determine the difference between a foreman and an employee. Any man can be an employee if you give him an appointment, but real foremen are very hard to get. Taking it for granted, we are all going to work to train natives of the Islands to hold such positions, I would like to ask if it is the opinion of this conference that it is the Bureau policy to run the risk in training these men on projects where the money is limited. My experience has been that good native foremen are a great deal harder to get than Americans. In provinces close to Manila it is very easy to get one or two. The Bureau of Education and many of the division superintendents admit that with all their experience they have two. Mr. Harrison says he has four. I would like to have ten if I could get them, but in the construction of projects where the money is limited and you don't know whether the men are capable of doing the work or no, is it the policy of the Bureau that we take the chance of training a man on a new project? My experience on school buildings with men who were said to be experienced but were not, is that in building a No. 10 building, the cost to the Government was ₱27,000. In building another No. 10 building, practically under the same conditions but by an experienced man the cost was ₱19,200. The question I want to bring out is when we have a limited amount of funds appropriated for a certain project, is it better to take a man with experience, whom we know can finish the project within the funds appropriated, or will we go out and become teachers and run the risk of having an overdraft? Are we warranted in running a risk on an excessive expenditure of from three to five thousand pesos in teaching the younger generation to become foremen?

Mr. **SYLVESTER**. I think Mr. Austin's question as to what we should do in the matter is answered in the confidential letter of the Director in which it is stated that our American foremen were expected to train men under them to take these positions; that the value of their services depended on their ability to do so.

Mr. **AGCAOILI**. I believe that the circular is very plain in that respect. I believe it says that the Americans who are working now can remain as long as they want to. Now, if the American foremen don't try to teach the natives, but merely discourage them, we ought to get rid of them.

Mr. **VANCE**. When are we to make the appointment of these students? Who is going to be responsible? If we have a project to construct, and so much money is appropriated, are we to put the work in the hands of a man we don't know; we don't know whether he can do the work or not? If we have an overdraft, according to the rules and regulations, serious consequences will result. Who is going to be responsible?

Mr. **HARRISON**. I would like to say, in reply to Mr. Austin's question: Unquestionaby some district engineers are more fortunate than others. There certainly has been as much money spent on overdrafts on buildings, etc., put up by American foremen as there will be in the education of a few Filipino foremen. An overdraft is dangerous, and inexperienced foremen are not desirable. My observations have been that American foremen are not by any means a guaranty that there will be no overdraft.

Mr. **BARRY**. It seems to me that this question has been thoroughly discussed. The policy of the Bureau is that native foremen shall be trained, but that this is a matter upon which the district engineers must use their judgment. He is to train native foremen as quickly as he can. I do not say that all American foreman are to be discharged under the circular. The American foremen should be used as supervisors of construction. There are native foremen far better than some American foremen; there are many American foremen better than most native foremen.

Mr. **SHUMAN**. We will take up the discussion on the maintenance of first and second class roads.

Mr. **VANCE**. I would like to make a few remarks on the hard and fast rule that exists now in regard to maintenance of roads without regard to traffic. For instance, in Samar, we have some first-class roads and there is no traffic on them at all; 95 per cent of the money spent on maintenance has been spent in cutting grass and this becomes a serious question as the mileage increases in the province. I think the system ought to be a little more flexible.

Mr. **AUSTIN**. In discussing effective maintenance of roads it is a fact that the most important thing is the matter of maintaining what has already been constructed, but as to defining the most effective method, I believe it to be absolutely impossible, for the conditions existing in each province are different. It seems to be absolutely a question which the district engineer has to work out and find out the best method to be adopted for effective maintenance. I have found both ways to be very successful. In some cases I have used one caminero for each kilometer during the rainy season and one or two for each kilometer during the dry season.

Mr. **VANCE**. That's the very point. Can't we get the Director to give us a little more leeway; make it a matter for the district engineer to decide for his own locality? The district engineer is always interested in saving money and in keeping the roads in good condition. If he can do it better than the rules drawn, he should have a little more leeway.

Mr. **VON SCHMELING**. In regard to road maintenance, I would like to say that there are certain roads constructed in the Philippine Islands in places that have not developed any traffic and naturally very different conditions prevail in different parts of the Islands, but generally traffic has trebled.

In choosing between gang maintenance and caminero maintenance, I would like to say that gang maintenance on a road, I don't believe, will keep the road in a serviceable condition. Gang maintenance only takes care of the larger places and leaves the smaller defects which enlarge and make the road impassable. I believe that on any road travelled at all, caminero maintenance is by far the most effective, but of course, there are exceptions to every rule. Caminero maintenance is not economical if it is not effective. The hardest work is to make caminero maintenance effective. If you compare the two systems, I think the caminero system is preferable.

Mr. **HENRY**. Another thing along practically the same lines which ought to be brought out for discussion is the question of flags, uniforms, stripes, etc., and some uniform system agreed upon that is to be used.

Mr. **VON SCHMELING**. As regards uniforms, they want to be used sensibly and should be used only for the purpose they are meant for—that is, to identify the camineros from the rest of the people that are about the kilometer, to make it easier for the inspector, foreman, capataz, or engineer. I believe that whatever color or system is to be used should be left within the province. Red for this purpose is preferred because it is cool. I am distinctly averse to anything fancy in uniforms. The uniforms should be working clothes and nothing fancy. White, I don't believe is very good. I don't believe they should be uniform throughout the Islands, but they should be uniform in each province.

Mr. **VANCE**. It might be of interest to know just what I have done in Samar in regard to uniforms. I recommended to the provincial board that they adopt a blue denim; that's a rough, dark material, but it is cheaper than khaki. The coat is to be a jacket, without collar, and the trousers will come to just below the knees. They get a suit in which they can work well and which is cool; it will wear well and it is cheap. In regard to the matter of stripes, I adopted the system of service stripes: ¼-inch stripes on the sleeve for one year of service; prize winners wear ½-inch stripes. The provincial board has already ordered the goods.

Mr. **VON SCHMELING**. In regard to flags, I would like to give you my experience on the subject. I simply used a tin flag and painted it white with the number in red. The caminero should put the flag at the place where he is actually at work and if the flag is there you will be able to see just what the man is doing, even if the caminero is absent. I would advise as a substitute for cloth, simply a tin flag, painted white, with the number in red.

Mr. **WEST**. What about the standard flag the Bureau is going to make?

Mr. **SHUMAN**. I believe that it is the intention to submit that to this meeting.

Mr. **HENRY**. I would like to have the opinion of the district engineers on the question of inspection; those whose foremen are using motorcycles. I would like to have the opinion of the different district engineers on this matter.

Mr. **HARRISON**. I have found that motorcycles are a failure on maintenance work. The average foreman that uses a motorcycle spends his time in riding the motor instead of inspecting the work and I personally don't like motorcycles. I have seen too many things gone over because it is too hard to start and stop the machine.

Mr. **CLARK**. My experience has just been the opposite of Mr. Harrison's. I have had a foreman and one motorcycle for a considerable time. For a while the motorcycle was in the repair shop and during that time there was a noticeable depreciation in the roads. My experience is that it is a great help to have motorcycles.

Mr. **WEST**. My experience with motorcycles has been very favorable. I am in favor of motorcycles.

Mr. **VON SCHMELING**. I certainly favor motorcycles.

Meeting adjourned at 11.40 a. m.

The afternoon was devoted to committee work.

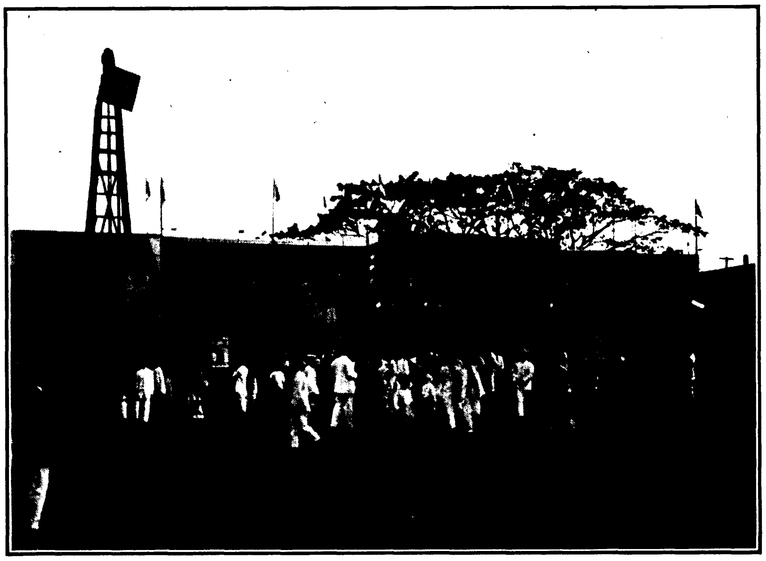
(*To be concluded in the next issue.*)

WE WIN.

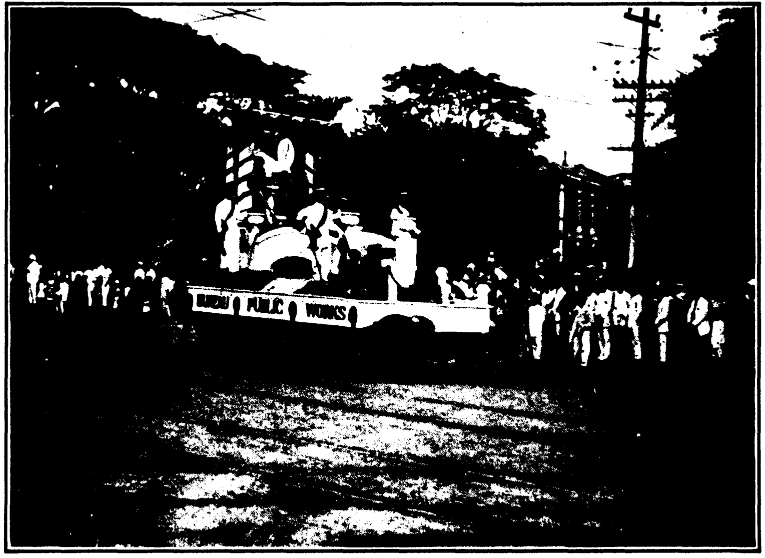
PHILIPPINE CARNIVAL AT MANILA, FEBRUARY 1–8, 1913.

A. H. SJOVALL, In charge.

The Bureau exhibit at this year's carnival was attractive to the average citizen. The Bureau's experience at the last two carnivals enabled it to show the dry subject of public works in a way that proved most popular. The site of the exhibit was behind a band stand, and in an out-of-the-way place due to the fact that the main street was strictly reserved for citizens who desired to spend money. In spite of this fact and without any special lighting, the attendance on several days reached 20,000 or more. The building was crowded to suffocation several times daily.



The carnival building of the Bureau of Public Works just before sunset February 9, 1913.



The large float in the 1913 carnival parade. It typifies the five main divisions of Bureau work, viz, road, bridge, building, artesian well, and irrigation. It is mounted on a motor truck.

The Bureau marshalled its forces and appeared in the street parades. There was a float typical of the work of the entire Bureau, and also one symbolical of road work. In the line of automobiles the Bureau had one car filled with Igorote girls representing Baguio, and in addition to this it competed for a comic prize. The great hit in the parade, however, was the camineros of Rizal Province in their new regulation uniforms. Their bearing was striking evidence that to labor in these Islands is no longer a disgrace. Their presence in the parade was due to the interest taken by the provincial board of Rizal Province.

As to the exhibit on the carnival grounds, it is difficult to pick out any particular drawing card. The artesian-well exhibit, especially an entirely new design of stratification model, and a large model showing the new Antipolo water system attracted a constant string of visitors. These models, like all other models shown, were in action.

The Consulting Architect to the Commission gathered in one place about 30 colored enlargements and drawings of buildings. This made the first complete exhibit of what was being done in architectural design. The space in front of this exhibit was usually jammed.

There were examples of concrete work for bridges and culverts, including both slab and girder and elliptical arch. The model of the Mañgaldan collapsible bridge aroused great interest. It was so arranged that a sudden rise of some 6 inches in the level of the water

The road-work float in the 1913 carnival parade at Manila. It shows the surveying, clearing, stripping, and excavation work on a hillside.

The camineros stationed on the first-class roads of Rizal Province turned out in full force with their capatazes. This was the first appearance of the regulation uniform.

carried away the superstructure of the bridge and the flood would then subside. In order to satisfy the popular interest in this model, it was necessary to order floods at short intervals, so often, in fact, that extensive repairs were needed each night.

A very large model of the proposed Santa Barbara irrigation project at Iloilo was shown. It was the most successful irrigation model exhibited in these Islands, mainly because it was large and low and was supplied with ample water. It was necessarily built in place and could not be preserved.

The smaller cup was a second prize taken in the parade of February 1, 1913, which opened the carnival. The larger cup was a first prize in the Filipino parade of February 2, 1913.

The main idea of the exhibit was to show the improvements which the several engineering construction policies have accomplished since 1907, and to demonstrate that these improvements had been effected in every province.

LINCOLN, THE ROAD BUILDER.

[Highway Magazine, February, 1913.]

The legitimate object of government is to do for a community of people whatever they need to have done, but can not do at all, or can not do so well, for themselves, in their separate and individual capacities.

In all that the people can individually do as well for themselves, Government ought not to interfere.

The desirable things which the individuals of a people can not do, or can not well do, for themselves, fall into two classes—those which have relation to wrongs and those which have not. Each of these branches off into an infinite variety of subdivisions.

The first—that in relation to wrongs—embraces all crimes, misdemeanors, and nonperformance of contract.

The other embraces all which, in its nature, and without wrong, requires combined action, as public roads and highways, public schools, charities, pauperism, orphanage, estates of the deceased, and the machinery of Government itself. From this it appears that if all men were just, there still would be some, though not so much, need of Government.—*Abraham Lincoln.*

PERSONAL MENTION.

C. E. Gordon, division engineer, returned on the steamship *Mongolia* on March 14 and immediately reported for duty.

Mr. Gordon made a very thorough and complete investigation of public works while in the United States, visiting more than 30 States. Special attention was devoted to investigations of modern road construction, especially of those types adapted to support automobile traffic.

Mr. Gordon reports especially that the maintenance system inaugurated on first-class roads in the Philippines as being far superior to the maintenance system on any roads in the localities visited by him in the States.

L. R. Brown, assistant engineer of this Bureau, returned from a long vacation in the States and has been assigned to the building division with headquarters in Manila.

R. H. Whinnery, well known in the Philippine Islands as an old employee of this Bureau, has gone into the contracting business and is associated with J. Atkinson, No. 1118 Storey Building, Los Angeles, Cal.

E. A. Pratt, formerly assistant engineer in this Bureau, has been heard from in Bombay, India. He is representing the Truss Concrete Steel Company (the Kahn system of reinforcing concrete).

W. A. Crossland, a former well-known district engineer of this Bureau, is now with the Office of Public Roads, Washington, D. C., building specimen roads in various parts of the country. Just now he is showing them how to build roads in Texas.

A. C. Nichols, at one time district engineer of Capiz Province, is now in a Chicago architect's office and doing well. He longs, however, for the fine, equable climate of the Philippines.

C. M. Pritchett, formerly chief division engineer of this Bureau and later supervising engineer, left for the United States on February 15, 1913. He expects to spend several months in the States and may interview Wilson.

H. F. Cameron, division engineer, will shortly leave for an extended visit to the States. Mr. Cameron expects to engage in a considerable amount of publicity work while in the United States.

G. K. Larrison, at one time an irrigation engineer of this Bureau, is at present in the Hawaiian Islands. Mr. Larrison is in charge of the gauging stations of Hawaii.

E. W. James, at one time assistant engineer in Bulacan and Nueva Ecija Provinces, is now chief inspector, United States Office of Public Roads, Washington, D. C.

John C. Koch, well known throughout Pangasinan and the Benguet country, is at present in charge of the highway extension work of the University of Georgia.

PROJECT NOTES BY DISTRICT AND DIVISION ENGINEERS.

ALBAY.

Resurfacing of the road from Legaspi to Ligao will be well under way by the end of this quarter. An investigation of available stone for road metal has revealed several classes of varying value. Volcanic stone is available all along the line, but has been found to be quite unsatisfactory. Constant attention is necessary in order to obtain good results with the volcanic rock. About one-third portion of this class of rock is a dense lava which makes good metal, but the other two-thirds is of light porous *scoria* which breaks easily, but when put on the road soon powders and leaves a hole. Naturally the tendency is to break the softer stone and this feature necessitates the close attention of the foreman. That this attention has not been given in the past is evident from the way the road wears into holes.

A quarry of excellent material has been opened near kilometer 14 and it is expected that the majority of the rock for resurfacing will be obtained on this site. A limestone quarry was found near kilometer 17, but the product is quite soft and will not stand the heavy traffic on this road.

Culvert construction on the Tabaco-Naga Road has been all completed with the exception of three small drain boxes in Tiui.

Piles for the Quinale Bridge at Malinao are being delivered. The superstructure for this bridge, which is two steel spans of 130 feet, will be started in April and should be completed in the next quarter.

Eight kilometers of trail on the Island of Catanduanes have been completed. The location of this trail follows the west bank of Bato River from Bato north to the divide between this river and Ojo River and from there down the east bank of the Ojo River to Viga. A 1-meter trail is being constructed with the idea of providing a means of communication for foot and horse traffic between the north and south coast of Catanduanes. The trail does not cross either of the two large rivers. It is about 50 kilometers long.

Satisfactory progress is being made on the Albay Intermediate School by the contractor, B. F. Mills.

Mr. Mills has also erected a seven-section grandstand on the athletic field and has built a wooden bridge acrosss the small stream between the provincial building and the school grounds. The latter was erected with prison labor.

AMBOS CAMARINES.

Four kilometers of the Nueva Caceres boundary road have been reconstructed this quarter. The work was greatly delayed by scarcity of labor in January and by the Easter holidays.

The reorganization of the caminero system, inaugurated January 1 has proved very successful. The camineros now receive a monthly instead of a daily wage, with increase for length and continuity of service. There is a very noticeable improvement in their work and attendance.

The Pasacao-Pamplona Road has been repaired and is now passable for vehicles.

One kilometer of sand-clay road has been constructed on the Sabang-Goa Road at a cost of about ₱800. The subgrade is very fine beach sand and was almost impassable for vehicles in the dry season. It was graded up to standard cross-section of 7 meters shoulder width and the shoulders sodded with Bermuda grass. Clay was applied, in a 4-meter width, in two layers of 7 centimeters each. The clay was mixed with the sand by the traffic and men to fill up the ruts and apply sand to soft spots that developed. A hard, smooth surface was obtained by this method. Clay was hauled about 3 kilometers in bull carts at a contract price of 65 cents per cubic meter.

All the bridges and culverts have been completed on the Tigaon-Goa Road, a ford built across the Arangus River, and other improvements made so that it is serviceable for vehicles of all classes.

Three pipe culverts—two 1 by 1½ meter and ½ by 1 meter standard culverts—have been constructed. Two of the pipe culverts are in the town of Nueva Caceres and, with catch basins, cost ₱71 each. The pipe culvert on kilometer 36 of Nueva Caceres boundary road with standard wing walls cost ₱112. The 1 by 1½ meter culverts, Nos. 10.05 and 13.35 cost ₱401.27 and ₱386.71, respectively. The ½ by 1 meter culvert No. 14.84 cost ₱250.26. These culverts were built by a native capataz under the supervision of the road foreman. The foreman's time is included in the above cost, but no engineering charges.

A one-room school building has been completed in the barrio of Gubat in North Camarines.

A new White passenger truck is now making trips on alternate days from Legaspi to Nueva Caceres. It makes the trip, 105 kilometers, in about six hours and the fare is ₱6.

ANTIQUE.

The district engineer has just finished surveying the Sibalom and the Bacong Rivers, from which surveys the design of protective work against the action of floods in the municipalities of Sibalom and Culasi, respectively, will be based.

The work on the Malandug and Bocboc Bridges is going on.

The cushion used in driving the concrete piles is made of old rope piled as shown ■ to a depth of at least 20 centimeters and then a 2-inch board laid on top, after which another row of rope is piled on it 5 centimeters deep. The follower is then placed and driving is ready. This method is proving very satisfactory so far.

The spill culvert (Project No. 12) is now completed and rigs can now go all the way from San Jose to Patnongon, a distance of 21 kilometers, 12 kilometers of which is first-class road. Construction on this road is going on beyond the twelfth kilometer.

Bridge-site surveys will be undertaken on the Calaoagan and Bongol Rivers in the municipalities of Tibiao and Culasi, respectively, as soon as the sounding outfit can be supplied by the Bureau of Supply.

The construction of the Lanaan School in the municipality of Lanaan has just been authorized and same will be started as soon as materials are gathered together.

The province has just authorized the purchase of a gasoline launch from the road and bridge fund. A launch of this kind will greatly help this office in getting around to the different works and will greatly reduce the time necessary to go from one town to another.

BATAAN.

Sections through barrios of the Balanga-North first-class road which have not been constructed to meet the Bureau standard are receiving attention. The province is reclaiming the full 15-meter right of way on all provincial roads by means of public meetings at every town affected, where provincial officials and others speak on the importance of this width. In general favorable results have been obtained.

Proposals are asked for the construction of culvert No. 19.00, 5 by 2.5 meters, on the Balanga-North Road. Culverts Nos. 21.08 and 21.40 on the same road will be advertised within a short time.

An effort is being made by the province to secure a loan from the Insular Government for the construction of important bridges.

BATANGAS.

It has become evident that in order to successfully maintain first-class roads in this province during the dry season either an effective system of watering has to be installed or the roads must be oiled. Both propositions are receiving serious consideration.

Work progresses satisfactorily on the Bauan-Taal Road. The foreman there is constructing a little less than 2 kilometers per month, which is really remarkable when it is known that the stone is hauled 12 kilometers by water, then crushed and hauled from 11 to 13 kilometers overland. The water for this work is hauled 9 kilometers, so that every little rain drop has a distinct value. Although this is a cost accounting project, the actual value of these drops, with proper surcharges added of course, has been a little difficult of determination.

Construction on the Sabang Bridge is being actively pushed. The contractors—Machetti Brothers—by April 1 will have their work safely above high-water dangers. This project is interesting in that it adapts local materials to a modern structure. The abutments and pier are of adobe masonry laid in locally procured lime, pointed with cement mortar, supporting concrete arches. The clear height of the arches at the center is just about 100 feet.

The two-room addition to the Santo Tomas School is practically finished. The old building suffers by comparison, and one cannot help but notice the improvement in the details of construction as shown on the present standard plans when the old and new are so closely connected.

The Balayan market building is finished, and satisfactory progress is being made on the Lipa market and tienda additions. The contractor for both is the Manila Saw Mill Company.

The Tanauan seven-room school building progress report shows principally lack of that item. However, with some coaxing, it is thought that the building will be ready for the opening of the next school year.

An interesting artesian well has been successfully drilled near the beach in Bauan. It is about 300 feet deep and is affected by the tides to such an extent that the flow varies from about 200 gallons per minute at high tide to about 50 at low water. The head on the well at high water is less than 1 foot, while at low water it just reaches the outlet pipes. The water is clear, bright, and tasteless.

If any district engineer knows of a satisfactory deep-well hand pump for artesian wells, adapted to use in the Islands, we should like to hear about it.

BOHOL.

At this time, material has been ordered for the construction of 11 small concrete bridges and culverts, 2 of which have already been begun.

The driving of concrete piles at the Panangatan Bridge goes on very well considering the fact that the work is all being done by hand. The jet does no good as the substratum is soft muck. The piles have to be raised and then dropped repeatedly until down. Extra piles have been driven on all piers to date to obtain necessary bearing. However, the last pier shows better bearing than the others and it is possible that the remaining pier and abutment will not require extra piles. Floor on one span is being placed and the others will follow immediately.

The driving of piles at the Bataria Bridge also goes on very slowly due to there being a layer of gravel near the surface which is impossible to take out by blasting. A cofferdam was built and this layer was excavated after which the piles have gone down very well.

The hoisting engine used is not heavy enough for the work and another has been ordered.

Besides these, there are three concrete-pile bridges on which construction has not begun.

A representative of the Insular Construction Company, the contractor for the Loay bridge, has been here and closed a contract with Juan Cabagnot for furnishing the timber foundation piles. Work will begin about May 1.

Resurfacing of Calape-Tubigon Road is going on. This project is more properly a reconstruction project as right of way is being obtained, ditches are being placed properly, and the surfacing is practically being made over.

The provincial board has requisitioned the purchase of a runabout automobile for the exclusive use of the district engineer. The requisition has been duly approved and will be immediately filed by the Bureau of Supply. The province has several hundred kilometers of first and second-class roads and it is anticipated that a small automobile will consequently increase the efficiency of the district engineer's inspection work as well as reduce the cost therof.

BULACAN.

The Hagonoy market was completed on time, March 15. The work done by the contractor, Mr. Choy, has been of very good quality and has progressed in a manner satisfactory to the engineers and creditable to Mr. Choy. The town of Hagonoy is fortunate in having this market and it is hoped that the revenues of the town may be considerably increased by the added receipts from the new building.

While work on the Obando market has progressed steadily, it has not been finished on time, and an extension of the contract time will be necessary.

The work on the Meycauayan market is moving along steadily, though not very rapidly. Work being done is a credit to the contractor and promises to give the town of Meycauayan a market building of which it can be proud.

The fill on the market at Pacombong is practically completed. This fill is being placed by a local contractor, Mr. Alva Borja, who is doing the work at an average cost of 95 centavos per cubic meter, which is a saving of about half a peso a meter over the prices offered by Manila contractors.

Work has been rebegun on the Bustos River wall. The work now in progress is under revised plans, the old plans having been unsatisfactory, owing to the large amount of bank carried away during the past rainy season. The old plans call for masonry facing laid on the bank at a slope of 1 to 1. The masonry facing was to be of adobe stone, one course thick, and laid in cement mortar. The new plans call for an adobe riprap, 1 meter thick, and laid at a slope of 1½ to 1. From observations made during the past rainy season, it is thought that the new plans will provide better protection than was provided by the old plans and will do this at a lower cost.

Construction on the Manila-North Road is progressing satisfactorily between Quingua and Baliuag. A force of men with two rollers is widening the road to 15 meters and placing a 4-meter surfacing course. Since January 1, something over 4 kilometers of road have been brought to first-class condition. Between Maasin and San Miguel, where road is also under way, something over 10 kilometers of subgrade have been completed and about 1 kilometer of surfacing placed. The surfacing of this road has been slow owing to lack of transportation.

The concrete work on Bocaue School (plan No. 7, partitions changed to concrete) was finished on March 8. The trusses are in place and it is expected that the roof will be completed by March 31.

The casting of concrete piles at Maasin was begun about the middle of February and is progressing steadily. It is hoped that driving can be begun within about a week and should be well under way by the end of March. Mr. A. F. Allen, the contractor for this bridge, is also getting his plant in shape and store houses built at Bolo and San Rafael.

About the middle of February the widening of the Quingua-Pulilan Road was begun. The right of way is being increased to 15 meters and the surfacing improved so that when work is completed the road may be declared first-class. Clearing is rather expensive, as the road now is only about 7 meters wide and thickly populated for its entire length. It is largely due to the efforts of the governor and the president of Pulilan that little trouble is being encountered in the securing of the right of way, both of these men being interested in road improvement and the governor particularly being very desirous of bringing the roads in Bulacan Province to the highest standard.

CAGAYAN.

Cagayan Province comprises the other half of the Cagayan Valley and must work to the same plans as those of Isabela for an overland communication with Manila the time required to make the trip at present being seven days from Tuguegarao. The present work of extending the Tuguegarao-North Road is a part of the plan. One other line of overland communication is possible for this province, namely, Aparri, at the mouth of the Cagayan River, to Benguet, Ilocos Norte, requiring about five days, of which only a short portion may be made in carromata or horseback. This is a possible route, but one which would require enormous expenditure for any other than a foot or pony trail. The bridge work in this province is at a standstill owing to tardiness of board in making application for a loan.

After a delay of several months, occasioned by the lack of funds, work has been resumed on the construction of the Cagayan court house, a loan for which was secured by the province from the Insular Government. First consideration is being given to economy of construction, therefore the work will not be rushed; however, it will not be many months until the building is complete. The cost of the construction, which is of reinforced concrete, will be about ₱60,000.

The force employed on the Tuguegarao-Cataggaman Road has been transferred to kilometer 10, Tuguegarao-Aparri Road, where the construction of first-class road is in progress. It is the intention at present to complete this road as first class to Iguig, a distance of 7 kilometers.

The construction of the 3 kilometers of first-class road between Tuguegarao and Cataggaman is about complete and where heretofore carabao walked in mud knee-deep with half-loaded carts, there is now a well-compacted gravel surface.

This road extends from the river landing in the barrio of Cataggaman to the center of the plaza in Tuguegarao where it connects with the Tuguegarao-Aparri Road, the first 10 kilometers of which is first class.

CAPIZ.

The Capiz-Loctugan Road has been finished. This road is 7½ kilometers long, has 6-meter subgrade, and 4-meter surface of crushed stone 15 centimeters in depth. Materials were hauled into place by tramway for 7 kilometers, and one-half kilometer by traction cars drawn by the road roller. Total appropriation ₱16,500. A small balance will be shown.

The Panitan Bridge work is progressing slowly, due to lack of equipment. The Insular Construction Company are doing this work.

This is an important structure and when finished will connect 27 kilometers of first-class road and 12 kilometers of third-class road through a highly productive section. This bridge is expected to develop automobile traffic which is the forerunner of future prosperity in this province.

One hundred and thirty carts daily are passing over the Cogon-Pontevedra Road. Before construction, not even a horse could pass over this road, while foot traffic was able to pass with difficulty. The road was built of hand-broken stone and for the surface finish a limestone binder was used. This gives the road a beautiful appearance and at the same time is a valuable ingredient on roads subject to overflow.

The subgrade is a red clay which contrasted with the white metalled surface gives a very attractive appearance.

The Capiz market is 50 per cent completed and by the end of April should be open to the public. A very superior quality of concrete work has been accomplished on this structure.

The distribution of caminero prizes has become quite a feature in Capiz Province, being attended with elaborate ceremonies and widespread interest.

CAVITE.

During the last three years construction has continued on the road from Imus to Silang.

The road is 26 kilometers long and all material for surfacing has been hauled from one end, making the present haul approximately 22 kilometers, as four remain to be surfaced.

The broken stone is delivered by railway and then hauled by carts at the rate of 30 centavos per cubic meter per kilometer.

When this road is finished it will make a complete hard-surfaced road from Manila to Silang (except 4 kilometers between Cavite boundary and Bacoor), a distance of 50 kilometers.

In the town of Cavite (San Roque) the municipality is building a standard plan, tile roof, closed court type market building 30 by 43.50 meters, under contract with the Insular Construction Company of Manila, and two sets of standard tile roof tiendas containing six and eleven compartments each.

The contract price was ₱21,873 for market building, ₱4,452 for block of six tiendas, and ₱7,907 for the block of eleven tiendas.

The location is in the center of the town and fronts on the inner bay, making it very easy to reach by the people who will have to use the market both for buying and selling, as carromatas can come in on one side and boats on the other.

The project is 90 per cent completed and will be finished by May 1, 1913.

The No. 3 school building in San Francisco de Malabon, and the No. 2 buildings, one in Julugan and one in Amaya, have been completed.

The No. 6 in Bacoor will be finished before June 1 as will the No. 3 in Carmona, making five projects completely finished and ready for use by the end of the present vacation.

A very good road and one that is opening up the country as shown by the great increase in traffic is under construction from Naic to Indang.

A standard cross section is being used with 20 centimeters of loose adobe base and 12 centimeters of compacted broken stone surfacing.

The stone is gotten by contract from Lake Laguna and hauled by cascos to Pandacan, there it is transshipped by train to Naic at a cost of ₱5.08 per cubic meter f. o. b. cars Naic.

From this point it is hauled by bull carts to its final resting place.

The construction was commenced in December and surfacing started on February 1.

Approximately 250 laborers are employed per day.

They receive pay each Saturday and are all back on the job Monday.

Five kilometers of subgrade are completed and 3 kilometers of surfacing finished.

All the land on both sides of road is irrigated, causing numerous small culverts to be constructed.

Right of way affecting some 200 parcels of land has been secured without a reclamo from one owner. The province rebuilds water ditches and constructs all necessary openings across roadway to put into force the same system of irrigation as was used before the construction of new road and then pays the owner of the land the actual amount he has paid the Government plus 15 to 20 per cent as a reasonable profit for the investment in the land.

The old road was in such bad shape that it was necessary to send a gang of men clear to Indang (20 kilometers) to repair road temporarily to let traffic through so that products could be hauled out and food supplies and building materials hauled in during the dry season to last during the time road is impassable.

The traffic on this road is over a hundred loaded carts a day, whereas, before construction started and during the rainy season there were no carts at all.

The Bureau of Lands is transferring to the Bureau of Public Works a road-constructing project which it has been pushing ahead from Malabon to Buena Vista.

Three kilometers of the subgrade are finished and gravel for approximately 2 kilometers is on deposit.

This road will be pushed on to Buena Vista as rapidly as funds will permit.

Surfacing is complete to kilometer post 19, the subgrade complete to post 22, Buena Vista central kilometer post being 26. The traffic on this road at present is not heavy enough to warrant a broken stone surfacing, river gravel being used which is put on at a depth of 20 centimeters.

At a later date, should traffic warrant a broken-stone metalling, the gravel that is now placed will make an excellent base.

CEBU.

Cebu Province has undertaken the reconstruction of all of its first-class roads, rebuilding the same to full Bureau of Public Works standard section. This work has necessitated the reclaiming of the 15-meter right of way (about 20 kilometers having been reclaimed to date) and the removal of the buildings and fences. In one municipality alone about 300 houses were moved back to provide the full right of way. There are three road rollers at work on this resurfacing at present; a hard coral from the Danao quarry being used on the Cebu-North and Cebu-South roads. On this work alone ₱160,000 will be spent during the year of 1913.

For the first time wheel traffic can now go from Cebu to the town of Catmon on Cebu-North Road. This road being first class to kilometer 48 and second class to Catmon.

The Cebu-Toledo Road was opened to automobile traffic on January 30 for the first time since the October typhoon. Between Asturias and Tuburan, where there has never been a road, work is progressing rapidly, there being constructed to date 8 kilometers out of 25, and a large force working on each end. This road will open up a large agricultural section, leaving as it does the sea coast just north of Asturias and following up the large and fertile Colonia Valley, meeting the coast line again at Tuburan.

On the Cebu-South Road a force is now working south from Argao constructing a full standard-section road with a light surfacing that will make a very good second-class road.

Argao is now the southern terminus of the Philippine Railway and this construction will put the people in the south end of the island in touch with the provincial capital.

There are three school projects under way at present. At Dalaguete a No. 10 plan school and at Boljoon a No. 7 plan school have just been begun, while at Oslob construction of a No. 7 plan will be started the 1st of April.

On the Barili-South Road several forces are at work at kilometers 81 and 104 working toward each other, cutting out impossible grades, bettering the alignment, and building a standard 5-meter road section.

Work on the Dumanjug market was begun, but owing to a desire of the Executive Bureau to change the plans it has been suspended.

Carcar market, under contract by the Insular Construction Company, is progressing slowly due to inability of contractor to secure materials. The concrete columns for the two market buildings are completed and concrete work on two sets of tiendas now under way.

CEBU CITY.

Calle Morga, one of the busiest streets in the city, has been improved with concrete curbs and gutters and surfaced with a 25-centimeter macadam stone from the provincial quarry at Danao.

Resurfacing of the provincial road within Cebu City is now in progress as well as the reconstruction of the old Spanish bridges and culverts.

Cebu Province has the following funds available for construction during the present year:

Roads and bridges	₱640,000
Schools	90,000
Markets	148,000
Water works	60,000
Total	938,000

ILOCOS NORTE.

A standard eight-room schoolhouse has been completed during the last quarter in the central barrio of Batac at an approximate cost of ₱20,000. A change in the location of the book and office rooms was made at the request of the division superintendent. These rooms, as shown upon the plans, seriously encroach upon the assembly room. In order to avoid this it was thought best to divide one of the seven by nine side rooms.

Work has been started upon the grade reduction of the Baruyen Hill, Laoag-Bangui Road. The maximum grade upon this hill is 23 per cent with a rise of 80 meters. The new location will reduce the grade to 6 per cent and lengthen the road 500 meters. A comparison of the net loads a baca can haul upon a 23 per cent grade and a 6 per cent grade may be of interest. For the sake of comparison let us assume that a baca can exert a pull of 400 pounds (one-half its weight) for short periods upon level ground, that the rolling resistance is 70 pounds per ton, viz, if the combined weight of carreton and load were 2,000 pounds it would take a 70-pound pull to move it upon level ground.

Let us figure the net load upon the 23 per cent grade first. The grade resistance per ton will be 23 per cent of 2,000 pounds, or 460 pounds. The tractive resistance will be the grade resistance plus the rolling resistance, viz, $460+70=530$ pounds, or it will take a pull of 530 pounds to carry a carreton load of 2,000 pounds up this grade. The baca can exert 400 pounds upon the level, upon the grade he will exert this less the grade pull, or 400 less 23 per cent of 800 pounds or 216 pounds (assuming the baca to weigh 800 pounds).

That is, the baca can exert a pull of 216 pounds upon the 23 per cent grade. The baca can pull a total load, then, of $^{216}/_{530}$ of 2,000=815 pounds; as the carreton weighs 200 pounds, the net load will be 815—200 or 615 pounds.

In like manner, for the 6 per cent grade the total or tractive resistance will be 6 per cent of 2,000+70 or 190 pounds per ton. The pull of the baca will be 400—6 per cent of 800=352 pounds. The total load the baca can pull will be $^{352}/_{190}$ of 2,000=3,704 pounds. The net load will be 3,704 less 200, or 3,504 pounds. The ratio of net loads will be $^{3705}/_{615}$ =6, or the baca can pull a net load six times as great upon the 6 per cent grade as upon the 23 per cent grade. If we had assumed that the baca could exert a pull of 300 pounds instead of 400 (which is probably more nearly the correct quantity), we would find this ratio to be 11.

ILOCOS SUR.

All the piles are cast for the four pile bridges at Sinait, Cabugao, Lapog, and Bical, under contract by A. F. Allen. At Lapog and Bical the two abutments are completed, and for the Cabugao bridge one-half the piles are driven and the superstructure is, on five bents, completed. Work is progressing very satisfactorily. The difficulties in driving piles had in the beginning have been overcome and with the adoption of a suitable pile cap the piles are being satisfactorily driven.

A special allotment of ₱60,000 from Act 2264 has been deposited for expenditure on the construction of the Vigan-South Road. Work is at present rapidly under way on the section between Santa Maria and Soso and on the section just south of Candon.

It is expected that during the present year all sections of the Vigan-South Road which were previously impassable during the rainy season will be reconstructed to a first-class standard. This will be done from the money at present available.

The contractor for the Candon bridge, Mr. Ytchon, has the excavations for the abutments completed and the materials are on the ground.

The section of the Manila-North Road, through the Subprovince of Amburayan, from the north bank of the Amburayan River to the Ilocos Sur boundary line, is at present under construction under the supervision of the district engineer of Ilocos Sur. Two hundred laborers are employed on this section of road at the present time.

An automobile truck line has been established and at present is making daily trips between Vigan and Laoag and between Vigan and Santa Cruz.

Another passenger line runs triweekly from San Fernando (La Union) to Vigan, the passenger fare being ₱20 one way.

There is also a second company owning automobile in Vigan who have cars for rent to make any necessary trips from Vigan.

ILOILO.

The province is undertaking by administration the construction of a No. 7 type of schoolhouse at Santa Barbara for the Bureau of Education. The site selected, at present used for the general market, is on the east side of the Iloilo-Santa Barbara Road.

Work on the reconstruction of Iloilo streets will be resumed shortly. The district engineer found it not only impracticable but dangerous to operate the new quarry on Guimaras Island during the northeast monsoon. With the change of monsoon in April, the quarry will be reopened. The province has advertised for the transportation of 5,000 cubic meters, all of which will be placed on the principal Iloilo streets under the supervision of the district engineer.

The Abangay Bridge is well under way. With its completion and the repairs which the province expects to make on the Pototan-Dingle Road, practically a new road will be opened up into Pototan which should greatly benefit this section.

The collapsible deck bridge over the Jalaur River between Pototan and Barrotac Nuevo was completed on the 28th day of January, enabling the hacenderos in this vicinity to handle the year's sugar crop overland instead of by water as formerly. The bridge was built by administration.

The Bureau of Public Works, however, allotted ₱5,000 for its construction, the province making up the deficiency.

Cost of Jalaur Bridge, Project No. 16.

[Taken from Form 251.]

Miscellaneous, including ₱524.86 for repairs and rental of pile driver, etc	₱1,266.07
Labor	861.61
Materials:	
All other materials and supplies	2,586.55
Cost of piles delivered	1,255.07
Surcharges	513.69
Remaining obligations, adjusted on actual expenditures	263.00
Total	6,745.99

In addition to the regular first-class maintenance, the provincial board has appropriated ₱40,000 for gang maintenance on second-class roads.

With this amount it is hoped to greatly improve the roads between Pototan and Dingle, between Cabatuan and Janiuay, and between Oton and San Joaquin.

A recent allotment provides ₱24,342 for the reconstruction of the Barrotac Nuevo-Dumangas Road. Work has just been started.

Work on the Jaro Bridge has been slow, due partly to the shortage of cement in the local markets. The center pier and the west abutment are completed, with the exception of the parapet walls on the latter. These are purposely left off, pending the arrival of the steel superstructure.

For the delivering of materials, a temporary spur track was laid from the Jaro Station of Philippine Railway Company to the bridge site and a derrick used for driving all piles for abutments, false work, and the sheathing for the cofferdams, the track being extended as fast as the false work was completed.

The fill under the spur track will be utilized for the west approach to the completed structure. Some difficulty in securing transportation from New York has delayed the delivery of the steel superstructure.

It is hoped, however, to still deliver the completed structure to the public within the contract time.

The roadbed and bridges of the Dueñas-Lambunao Viejo Road, Iloilo Province, are completed as far as the barrio of Cabudian, 9.3 kilometers from the railroad station at Dueñas. This leaves 4.4 kilometers of roadbed to be constructed before reaching an old Spanish road, from which junction point there will be 4.2 kilometers of the old Spanish road to reconstruct, to finish the proposed road to Lambunao Viejo. Tramway has also been laid for hauling gravel on this road and it is expected that the road will be surfaced as far as Cabudian by the end of the dry season.

This road runs through a rolling country as yet undeveloped. Several large interests, however, are opening up haciendas along the located line as a result of its construction.

When completed it will undoubtedly justify its construction from a standpoint of traffic, besides being one of the most attractive roads in the province.

Preliminary survey and estimates for the Lucena-Jalaur Road have been completed and ₱30,000 has been appropriated toward construction. This road will start from Lucena, on the Philippine Railway, and run 7½ kilometers easterly through continuous rice paddies to the barrio of Jalaur on the Jalaur River. At Jalaur there are several hundred hectares of sugar section, the richest in the province. Arrangements are being made to start construction about March 5. As the grading is practically all borrow and fill, it is expected that the work can be let out in small contracts directly to the laborers.

Work on the Oton, Jaro, and Santa Barbara markets is progressing finely.

At Oton all columns are in place for a 52.5 by 28.5 meter standard market and for a block of six standard tiendas. Lumber for the trusses is on the ground. Two thousand cubic meters of sand have been placed in fill under and around buildings.

At Jaro all columns have been completed for a 12 by 75 meter standard market and also for a three-tienda extension to a present building. Four hundred cubic meters of earth fill have been placed.

At Santa Barbara all columns for a 57 by 28.5 meter standard market are completed and 25 per cent of the floor has been laid. Two hundred and fifty cubic meters of earth fill have been placed under the building.

ISABELA.

Isabela Province, composing about one-half of the Cagayan Valley, has so planned the road and bridge work for the next ten years that within that time communication overland will be had with Manila, connecting with railroad or Manila-North highway, at Tayug, Pangasinan, via Nueva Viscaya. There remain only some 15 kilometers of bad trail in Nueva Vizcaya and about the same in Isabela, on either side of the boundary line, to be accomplished at the present time. The trip from Tayug to Carig, Isabela, can easily be made by horse in four days. From Carig the first-class road extends to Echague and this road is being extended north to Angadanan during the present season and during the years 1914 and 1915 the road construction will reach Cauayan on the Cagayan River, which point barangayans can reach at all seasons. At the same time the work on bridges and culverts is going on between Ilagan and Tumauni north and some road work between Cabayan and San Pablo. This province is without doubt making toward the very best ends to be obtained as to economic needs, and the funds for road and bridge work are wisely distributed.

The provincial park of Isabela, located in front of the government and municipal buildings, has just been completed. It is a combined park and athletic field, containing a race track, tennis courts, basket ball, and volley ball fields. The park has very materially improved the appearance of the central park of Ilagan in which these public buildings are situated. Plants were immediately planted on completion of the park. The municipal officials now propose to have the band and orchestra play in the park every Sunday.

A 440-yard race track, 8 feet wide, which for some time has been under construction by the school authorities, was turned over to the district engineer for completion; it was completed in time for the Cagayan-Isabela athletic meet. The track is laid out around the high-school building and has added considerably to the appearance of the school grounds.

LAGUNA.

Work on the Calamba-Canlubang Road was begun on March 17, and will be pushed so that the entire road, 5.5 kilometers long, will be completed during this dry season.

The Calamba-Vigaa Road, 8 kilometers long and connecting the Batangas road system with the Manila-South Road, has had considerable repairs made on it, and, while still rough in places, affords safe and easy passage for motor vehicles.

The town of San Pablo has just spent ₱5,000 under the direction of the district engineer in macadamizing some of its principal streets, and the municipal officials have expressed their intention of having several other streets repaired next year when funds will be available.

Temporary repairs are being made on the San Pablo-Nagcarlan Road, and it is now possible for motor vehicles to go as far as barrio Putol, 11 kilometers from San Pablo.

Work will be continued and the road repaired as far as Nagcarlan where a new market will be erected shortly.

The output of the Los Baños quarry for the quarter ending December 31, 1912, was 7,479.50 cubic meters, which was sold for ₱22,438.50 on board Manila Railroad cars at the quarry. The output for the quarter ending March 31, 1913, will approximate 6,400 cubic meters, valued at ₱19,200. This falling off 1,000 cubic meters was due to the inability of the Manila Railroad Company to supply the necessary transportation.

Were the Manila Railroad Company able to furnish sufficient transportation the output could be greatly increased, since the plant running steadily can crush 4,000 cubic meters per month.

With an expected increase in shipping facilities due to the receipt by the railroad company of 10 new locomotives, and with the completion at an early date of development work in the quarry, it is believed that the price of the stone can soon be reduced to ₱2.50, or even less, per cubic meter on board cars at quarry.

If future demands are sufficient to justify it a large plant should be constructed. The tentative plans for this provide a large gyratory crusher; the use of the two Champion No. 4 jaw crushers now in use to crush the rejections from the large crusher; a roller crusher to crush 2-inch stone to ½-inch and smaller for maintenance work; steam drills for the quarry; and storage bins over the railroad track sufficiently large to load the maximum train handled by the freight locomotives of the railroad company.

LA UNION.

Quarantine was lifted at Bangar on March 8. The gravel contractor has commenced hauling first-course gravel on Section I from Bangar to North Boundary.

The subgrade between Bangar and Balaoan is nearing completion, 1½ kilometers still to be completed. The culverts on this section of road will be put in as temporary structures this season, being replaced by permanent ones next season.

The survey of a new line connecting Luna and Balaoan has just been made. It is hoped construction can be started soon. At present, lack of funds is retarding the construction of this much-needed improvement. The old Spanish road followed the Pantar River part of the way, with the result that the road was continually being washed out in rainy seasons. The new route takes a direct course from Luna, making a 3-kilometer tangent, where it intersects with the old road leading into Balaoan. This route cuts out several curves.

The Bauang-Caba Road is nearing completion; approximately 2 kilometers of second-course gravel has been spread and is ready for rolling. A 3-ton roller, pulled by four mules is being used. The last half kilometer of subgrade is under construction. This brings the road into the town of Caba. This project will be completed by June 1.

The Naguilian collapsible bridge will shortly be completed.

Several schoolhouses are under construction in this province. Plan No. 7 school at Naguilian will be completed by April 1.

The provincial board under resolution No. 2, series of 1913, unanimously approved the location plan for the new interior location of the through North Road from Bacnotan to Balaoan and Bangar, through the barrio of Bungol.

LEYTE.

Since the first of the year work has been steadily continued on the Tacloban-Carigara Road, bridges, and culverts.

Bridge 27.9, a standard reinforced-concrete structure of 5 by 4.5 meters, was completed at a cost of ₱3,300. The form lumber for this bridge was carried away by the baguio and 70 barrels of cement were spoiled, which accounts for its high cost.

Culverts Nos. 27.76 and 27.82, standard reinforced concrete structures of 3 by 2.5 meters each, were completed at a cost of less than ₱1,400 each.

Culvert No. 27.12, a standard reinforced-concrete structure 2 by 2 meters, was completed at a cost of ₱757.

Work has been started on the Lingayon Bridge on the Tacloban-Carigara Road. This is a standard 12-meter girder bridge with skew abutments supported on wooden piles.

Pending the arrival of boiler and hoisting engine these piles are being driven by hand at a rate of 5 per day, costing ₱1 per lineal meter in place. This includes purchase price of piles, which was ₱2.25 each, delivered at bridge site.

The Dagami-Tanauan section of the Palo-South Road has deteriorated badly on account of the baguios of October and November and also because the actual increase of traffic on this road has been over three times that anticipated. Trains of heavily laden carts of 15 to 25 in each train are continually passing over this road. Also two transportation companies run 2-ton automobile trucks over it twice daily. These trucks are always full and do not seem to be able to take care of all the traffic. The resurfacing of this section has just been started. The problem is to find stone for this work and transportation to the road at prices which are not prohibitive. The stone from the Palo quarry at kilometer No. 12 is of excellent quality, but its distance from the section to be resurfaced (kilometer 18–30) only permits its use as far as kilometer No. 24. This stone costs ₱1.50 per cubic meter in the pile. Transporting it costs 40 centavos per kilometer meter. The remaining kilometers will be resurfaced with gravel from the Dagami River, which can be obtained by contract at ₱2 per meter on the road. On account of the unexpected increase of the traffic it has been deemed advisable to increase the width of surfacing to 4 meters. The total cost of this resurfacing including the widening to 4 meters is estimated at ₱19,000.

The construction of the Dulag-Burauen Road has been recommended, this work having been suspended on account of lack of funds. Grading has been completed for 3 kilometers.

A locomotive has been purchased for use on the tramway and it is expected that it will very materially decrease the cost of the surfacing. The rock for the surfacing is obtained from the Burauen River which runs about parallel to the road at a distance varying from 1 to 3 kilometers.

This road has no grade greater than 2 per cent. It runs through an exceedingly fertile hemp country, very rich in natural scenery. When completed, it will be one of the most beautiful in the Philippines as well as opening up an important stretch of country.

MISAMIS.

Nothing reported by the district and division engineers.

NUEVA ECIJA.

Thirteen kilometers of grading has been completed on the Baloc-San Juan de Guimba section of the Manila-North Road; and 6 kilometers of surfacing is completed with the exception of the finishing rolling. The work on this section of the Manila-North Road is being done mostly by Ilocano laborers who have recently immigrated to the Province of Nueva Ecija and are making very satisfactory laborers. About 90 per cent of these laborers have taken up homesteads in the vicinity of this work and road construction is becoming easier every day in the Province of Nueva Ecija. It is expected to complete this section by June 30, 1913.

Six and one-half kilometers of grading has been completed on the Gapan-Bulacan boundary section of the Manila--North Road and 5½ kilometers of surfacing placed and partly rolled. It is expected to complete this section by June 20, 1913.

The concrete work on the Malimba, Tabuating, and Baliuag River bridges is 60 per cent completed, and it is expected to complete the substructure of these bridges by May 20, 1913.

The maintenance of first-class roads is one of the most difficult problems in the province owing to the heavy traffic and dry weather. The census shows that over 800 loaded bull carts pass over the first-class roads daily. Roads are now being maintained by hand wetting and tamping which is proving to be very satisfactory. It is estimated that at least 2,000,000 cavans of palay will be transported over first-class roads between February 1 and June 30, 1913. Four-meter surfacing has proven to be entirely too narrow for the transportation in the province.

One hundred and eighty-four kilometers of third-class roads have been repaired so that loaded bull carts can pass over any part of them.

Sixty kilometers of trail suitable for pack animals have been completed in the vicinity of San Jose, Carranglan, Pantabangan, and Rizal.

Temporary bridges, or balsas, have been constructed and maintained at all important stream crossings and it is now possible to travel more than 200 kilometers in carromata or light automobile in the province.

Special mention is due the municipality of San Antonio for the interest in road construction, they having appropriated ₱2,000 to aid the province in construction of the road from San Antonio to San Isidro and are doing this work themselves, under the supervision of the district engineer.

Artesian wells (pump wells have been constructed in 14 municipalities in the Province and the maintenance of these wells has been turned over to the district engineer. Some difficulty has been encountered in finding a pump that would stand the hard usuage as required in the municipalities where these wells have been constructed. The Humphries rotary pump with steel cams has proven to be the most successful. Pumps with brass cams will not stand the hard usage required by a municipality. The towns of Aliaga and Cuyapo are planning to construct two first-class artesian wells this year.

Telephone lines are being constructed connecting all municipalities with the central office in Cabanatuan, and it is now possible to communicate with every municipality in the province, excepting four, and it is expected that the system will be completed by June 30, 1913.

San Antonio and the Cabanatuan school buildings have been completed, and it is expected to complete construction on San Juan de Guimba, Jaen, Bongabong, and Nampicuan school buildings during the coming school vacation. The work on the new mess hall for the Central Luzon Agricultural School is completed, except painting, which will also be done during the coming school vacation.

OCCIDENTAL NEGROS.

Biniquil Bridge, project No. 5, was completed by the contractors, W. H. Lambert & Co., Iloilo, Iloilo, on February 13, 1913. The structure consists of five 7-meter standard spans on concrete piles.

Much difficulty was encountered in driving piles, owing to a layer of shell. The severe typhoons which occurred during construction caused great loss of time and materials. One hundred and forty-five barrels of cement were destroyed in one storm.

The lack of cement in the entire Philippine market further delayed the work, so that, in all, ten months were required to erect the structure.

Owing to the difficulty of access to the site the contract price was high, being ₱12,560, exclusive of reinforcing steel.

Cost of steel, extra work, work on approaches and inspection will bring the total cost to approximately ₱21,000.

The provincial pile driver was rented to the contractor for this job.

The damage done by the typhoons of the past year to first-class roads and bridges is being rapidly repaired. Imbang Bridge and the vicinity suffered severely. The sum of ₱15,590 has been appropriated by the provincial board from funds allotted to Occidental Negros under Act No. 2199 for reconstruction of damaged roads and bridges.

At Imbang Bridge, a two 25-meter arched structure with open spandrels, the river scoured around the north abutment sufficiently to expose the piles. As no rock or other material is available for riprapping, concrete blocks are being prepared for that purpose.

In the San Carlos section, the San Carlos Milling Company have erected two temporary wooden bridges to replace destroyed concrete structures, the provincial government paying half the expense.

The prolonged sugar-grinding season has caused a continuance of the heavy bull-cart hauling incident to the period, which, together with dry weather and a very poor quality of gravel, has rendered the maintenance of the Bacolod-North Road particularly difficult.

The tendency of bull-cart drivers to use the shoulders, instead of the surfaced portion, to favor the carabao's feet has materially damaged the roads, while heavy automobile traffic and high winds have continued to cause deterioration.

Construction of La Carlota market and tiendas is well under way. One market building and one block of tiendas are to be erected by the Insular Construction Company, contractors, at a price of ₱19,127 for the market and ₱9,226 per block of tiendas. Extra work, grading, and surcharges will bring the cost to approximately ₱36,000, under direct supervision of the district office.

Bacolod Central School, project No. 23, was completed February 1, 1913. A standard plan No. 10 building was constructed by Mr. J. E. Ainsworth, contractor, at a contract price of ₱19,500, under direct supervision of the district office. Surcharges and incidental expenses brought the total cost up to ₱21,471.69.

The building was formally taken over by the municipality with fitting ceremony in which the municipal and provincial officials participated.

The site for this building was donated by Mr. Juan Araneta, of Maao, Negros Occidental.

ORIENTAL NEGROS.

The Siaton Trail was practically completed by the joining of the two sections in the middle during the month of March.

This trail begins at Zamboanguita at the end of the second-class road south from Dumaguete and, after crossing two rivers with fair fords and winding around through some extremely rough and rocky country, climbs to a high, barren, uninhabited mesa and follows over its rolling ridges and deep gullies for several kilometers, finally dropping into the valleys again near the pueblo of Siaton.

The total length is in the neighborhood of 28 kilometers. It opens up a passable road to Siaton and the distant municipality of Bayauan on the west coast of Oriental Negros. The former route of travel by land was along the beach, and large esteros and abrupt rocky headlands projecting into the sea made this route almost impassable.

The trail is for horse and foot traffic primarily, as but few wheeled vehicles exist in this section, but is passable for carts as well, only a few points being narrow enough to be difficult.

The main constructional difficulties were the steep slopes from the plateau to the valleys, the deep gullies, the large boulders strewn everywhere, and the difficulty of providing laborers in a country where there existed neither food nor water except during the extremely uncertain rainy season.

Work is now being carried on on two schoolhouse projects after long waits on both for funds and materials. The Ayuquitan is a new standard Bureau of Education plan No. 3. The Larena School is a reconstruction project very nearly equal in size and shape to the old standard No. 5. With the supervising teacher, municipal councils, superintendent of schools, and provincial treasurer all pulling with us the buildings bid fair to be completed this time without further delays.

The lieutenant-governor of the subprovince of Siquijor is still building water-supply improvements. A 1,600-gallon reinforced-concrete storage tank has been coupled into the system of the municipality of Canoan which will enable a large part of the night flow of their mountain spring to be held for use during the day in times of heavy demand. He has also caused to be walled in a neat sanitary manner the outflow basin of the mammoth spring at San Juan. This prevents contamination by the entrance of animals and makes it compulsory for the people to secure their supplies of water at the outlet of the basin where any contamination by the water carriers will be immediately washed on out to sea by the swift current. His most noticeable achievement in this line during the last few months, however, is the construction in the public plaza of the town of Siquijor of a neat public bath. This is being done mainly by donated labor, and with materials bought with donated funds. The structure is of reinforced concrete and has public water taps and four public bathrooms on the ground floor. Above is a band stand, with overhanging balconies all around, reached by four flights of concrete stairs and with provision for a pagoda-shaped roof.

The old provincial building in Dumaguete has in the past received many remodelings and by this means has been improved greatly. Recently another addition and some remodeling has been completed which enables it to house, in separate offices, the division superintendent of schools, the district health officer, the provincial fiscal, and the large and busy first-class post-office of Dumaguete, in addition to the offices it formerly held. Three commodious storerooms and the telephone office occupy the ground floor of the new addition.

PAMPANGA.

Nothing reported by the district and division engineers.

PANGASINAN.

Rinderpest quarantine has seriously delayed work in the eastern section of the province, it being absolutely impossible to secure sufficient gravel carts to keep one roller busy. The quarantine also held up construction for two months on the last bridge of the Rosales-Binalonan Road.

The Hermosa dike was completed on February 28, by contractor Delmar Smith-Clinton, a total of 30,078 cubic meters of earth fill being placed at a total cost of ₱23,700.

Two steel bridges of 27.4-meter span each, one with 5-meter and the other with 10-meter I-beam approach spans, were completed by the Insular Construction Company in March on the Lingayen-Balincaguin Road. The same contractor in January also completed one 24.38-meter steel span on old brick abutments and 22 box culverts, total span 157 meters, on the Rosales-Binalonan Road at a total cost of ₱32,768.64.

Contractor A. F. Allen completed in February his contract for the construction of four concrete pile bridges on the Rosales-Binalonan Road at a total cost of ₱40,825.93.

Smith, Bell, & Co. have placed a 3-ton White truck with 3-ton trailer on the Tayug-Dagupan run for transporting palay.

A new automobile of 12 passengers capacity has been added to the Dagupan-Tayug run.

The action of the municipal council of Mangatarem in respect to right of way is to be noted. At the request of a representative of the Bureau an ordinance was passed ordering all houses and fences from the 15-meter right of way throughout the municipality.

This work has now been completed and both the citizens and municipal officials take pride in the results.

Construction of a 16-room primary school building, Bureau of Education standard plans, has been started at Lingayen.

A traffic census taken during the early part of January, this year, showed a daily average of 747 pedestrians using the road between Urdaneta and Binalonan. This road has not been open to vehicle traffic for a great number of years. The road, however, is now being constructed as first class and this amount of pedestrian traffic readily indicates the enormous amount of vehicle traffic that may be expected immediately after its completion.

RIZAL.

The treating with standard road oil No. 6 of 7 kilometers of the Manila-South Road from Pasay to Las Piñas was completed during January.

The method of treatment was a radical change from that used on the section of the South Road from Zapote to San Pedro Tunasan last year with, it is believed, improved results and a great reduction in cost. After various experiments on small areas and from experience gained in the previous year the work was carried on in the manner described. In brooming the road, preparatory to oiling, only the finer portion of the original road binder was removed, no water was applied, and the oil was spread as before, approximately one-half gallon per square meter, allowed to stand from thirty-six to seventy-two hours or until the surface oiled appeared dry before covering with sand as against the three to five hours allowed last year. It has been observed that the oil does not penetrate the road at an even rate, probably due to the fact that some spots are more densely compacted than others, as five or six hours after application alternate dry and wet spots will be noticed. If sand is applied the oil in the wet spots will be taken up by the sand and not penetrate the road as desired. After three or four months' wear the smooth asphalt-like surface will appear broken, the spots where the oil was taken up by the sand having disintegrated.

Dredge-run gravel in sizes up to three-fourths inch was used instead of sand and the amount per kilometer reduced from 30 cubic meters to 20 cubic meters. It is believed that in using gravel the maximum penetration in the road body will be obtained.

Road rollers were not used. Immediately after spreading the gravel, traffic was forced upon the section with results as good as have been obtained by use of a roller.

The road now presents the appearance of an asphalt surface and absolutely no dust is raised by the fastest moving automobiles, quite a contract to the past dry season when almost an impenetrable pall of dust was hanging over the road at all times.

Following is tabulated a comparative cost of treating with oil last year and this year.

Kilometer 5, Manila-South Road—water-bound section showing dust cloud raised by fast-running auto.

Kilometer 10, Manila-South Road (oiled section); auto running 50 miles per hour, no dust raised.

Item.	1912		1913	
	Zapote to San Pedro.		Pasay to Las Piñas.	
	Cost.	Per cent of whole.	Cost.	Per cent of whole.
Oil	₱460.00	48.36	₱460.00	85.00
Sand	67.00	7.07	45.00	8.00
Sprinkling	66.31	6.96		
Rolling	74.94	7.87		
Hauling				
Brooming, spreading sand, etc	182.30	19.15	(a)	
Spreading oil	100.98	10.60	40.00	7.00
Total	952.03	100	545.00	100

[a] Included in spreading oil.

NOTE.—The variable feature hauling has been eliminated in order to make an equitable comparison. The other features remain the same in both cases.

A second application of standard road oil No. 6 was made on kilometer 14 (old numbers) Manila-South Road. The first application of one-half gallon per square meter was made about one year ago. The oil this year was applied one-fourth gallon per square meter, allowed to completely penetrate the road, and covered with gravel 15 cubic meters to the kilometer, traffic was turned on the road immediately after spreading the gravel. The results were very gratifying.

The cost of the operation follows:

Oil	₱230.00
Applying	40.00
Sand	45.00
Hauling	70.00
Cost per kilometer	385.00
Cost per square meter	.096

In connection with experimental work with oils and asphalts, 400 gallons of Texaco road oil were used on kilometer 5 (old number).

This is a patent road oil, specific gravity 1.01 (in office records) and very light as compared with standard road oil No. 6. It was applied three-fourths gallon per square meter. The oil completely penetrated the road within two hours. Half inch screenings were spread and traffic turned on the section. After three days disintegration had set in and at the end of three weeks the section had to be water bound again, all evidence of the oil binder having disappeared, and its use as a road binder a complete failure.

Some difficulty has been experienced in maintaining the asphalt section of the Manila-South Road. This portion is subjected to an enormous traffic, some 2,000 vehicles passing daily. The majority being heavily loaded, narrow-tired carretelas. Abrasions in the sealing coat of asphalt, varying in size from 6 to 24 inches in diameter, are constantly developing and, if not immediately repaired, water enters the road causing complete disintegration.

Repairs were first made by picking out the injured section and building up the patch in the same manner that the original asphalt was laid. This required the constant attention of a road roller and repairs cost approximately ₱5 per square meter. This method was superseded by thoroughly brooming the dirt and fine materials from the abrasion filling with a sealing coat of asphalt, and bringing the patch up to grade with screenings or gravel. It subsequently developed that screenings gave the best results and were therefore used entirely.

This method was cheap and successful except where the patch was above or below the original surface, in which case a new abrasion developed on either side of the patch.

The pavement is now a year old and the sealing coat worn through in a number of places due partially to the fact that gravel was used as a filler in applying the sealing coat, partially to age and other factors impossible to obviate without great additional expense. After several experiments, a section of the road 320 meters long was thoroughly washed and cleaned of all foreign matter, abrasions scarified and brought to grade, and a coating of asphalt, one-half gallon to the square meter, applied. While still hot, screenings were spread 1 centimeter thick and thoroughly rolled, the road being immediately thrown open to traffic. The result has been indeed gratifying. It is believed that the screenings will hold up much better under traffic than gravel, thus sustaining the sealing coat of asphalt, and eliminating the constant repair of abrasions. The applying of a top dressing in the same manner to the entire asphalt section is anticipated.

The work was done at a cost of ₱0.247 per square meter:

	Total cost.	Per square meter.	Per cent of whole.
Asphalt	₱144.00	₱0.091	36.5
Applying, labor, heater, etc	116.40	.074	29.4
Screenings	60.00	.038	15.6
Rolling	53.50	.034	14.0
Hauling materials	15.00	.010	4.5
Total	388.90	.247	100

Work has been started on the Tonsuya bridge repair at Malabon. The bridge is a Spanish structure of eight 10-meter arches. The work consists of repairing abutments and piers, replacing dislocated vossoirs in arches, constructing overhanging sidewalks, etc.

A three-room schoolhouse in Antipolo is nearing completion, the materials being furnished by the province and the construction under contract.

SAMAR.

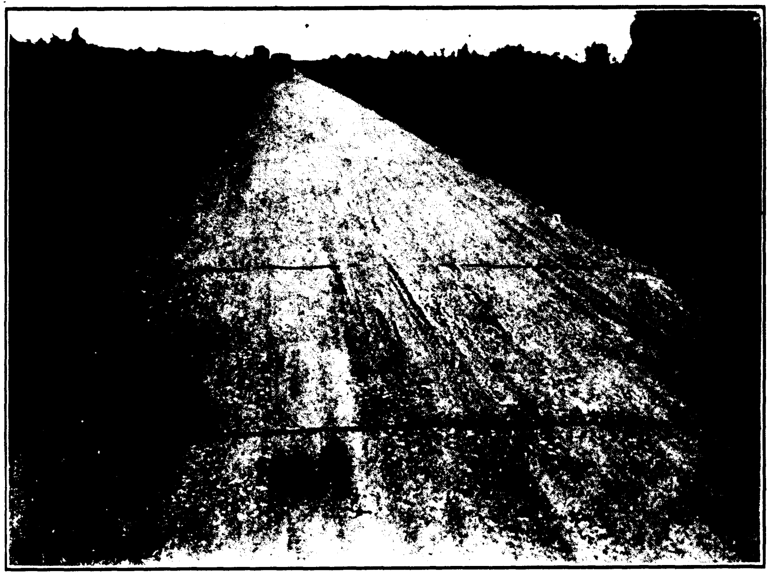
Work began March 23 on the Guiuan-Salcedo Road. This work is undertaken mainly as a relief measure. The district through which it passes felt the full force of the typhoon of last November.

Guiuan is the most southerly part of Samar. A steamer calling every fifteen days used to take out 800 and more sacks of coprax. The baguio of November, 1912, passed over this country and now less than 100 sacks are being shipped from this port. A material increase in the export cannot be expected before 1915. Coprax was the main product and the entire length of the road passes through what was once one continuous grove of magnificient coconut palms. The few trees left standing and that retained even a part of the bud or heart at the top are making a brave fight for life, but it will be several years before they will produce anything like their former quantity of nuts.

It would seem that a little surgery in the way of cutting out the dead leaves and decayed tissue of the buds would help and speed the process of heading, but this does not seem to be "costumbre," as it necessarily involves some real work.

Past experience in road construction in the southern part of Samar has not proven the justification of the expenditure of funds for first-class road construction; for this reason the Bureau of Public Works is now undertaking trail construction, which will permit of reaching the interior of this undeveloped province at comparatively small cost. These trails will be well-drained pack trails with grades not exceeding 6 per cent, crossing streams with temporary structures, making use of suitable timber available locally, which will permit us later, if same proves justified, to improve these trails to conform to the standard of the first-class roads. For this reason the full right of way of 15 meters is always being secured upon commencement of this trail construction. Plenty of labor is available at the daily wage of ₱0.50. The cost of this trail construction is estimated at ₱1,000 per kilometer. An experienced trail builder is foreman in charge of this work, who is capable of protecting the grade and securing the most advantageous alignment.

The repairs to the causeway on the Borongan-Sulat Road, which was practically destroyed during the last typhoon have been completed at a cost of some ₱500. This does not include the cost of the two small bridges which went out at the same time. The tidal wave, which caused the damage, rushed over the causeway 1½ meters higher than any former record of a similar occurrence in this locality.



Kilometer 20, Manila–South Road—junction of section treated with standard road oil No. 6 applied May, 1912, and water-bound macadam. Ropes stretched across both classes of road showing heavy wear on water-bound macadam road and none on treated section.

The Catbalogan-Moulong Road at Catbalogan is being extended to opposite the wharf at Catbalogan.

Labor is still scarce and irregular on the Calbayog-Gandara Road.

Tenders are asked for the construction of a standard No. 7 school building at Catarman on the north coast.

SORSOGON.

Work has been steadily continued on the Sorsogon-South Road but has been handicaped by the almost continuous wet weather. Grading, except for 1½ kilometers, has been completed while surfacing has been finished to the end of kilometer 12.

Preliminary surveys have been made for the Sorsogon-Albay interprovincial road, but there is yet some doubt as to the exact location, a total distance of about 56 kilometers from Albay to Sorsogon over rough, mountainous country for the greater part.

Work has been continued on the Pawic River bridge and a short time should see it finished. Labor is still scarce in the Bulan district.

The right of way has been cleared and grading started on the Colorado mine to Macatul Point Road, a distance of 2.4 kilometers. This road will be a great help to some of the Aroroy mines, in particular the Colorado which is steadily operating 20 stamps and the Eastern, where a 20-stamp mill will probably be installed this year.

A third flowing artesian well has been drilled in the town of Sorsogon and the machine is now operating in the town of Bacon.

A plan No. 2 standard Gabaldon building has been completed at Aroroy.

SURIGAO.

Active construction on Placer-Mainit Road was commenced March 1. Labor, however, is very scarce and consequently arrangements have been made with Lieutenant-Governor Fugate of Siquijor to supply this province with 150 laborers. These men will be placed on the Placer-Mainit Road and it is expected that with this labor the grading will be finished to the town of Timamana (kilometer 12) before the next rainy season. Bids have been asked for delivering surfacing material on this road.

Surveys are being made for a proposed waterworks system for the towns of Surigao and Placer. Both of these towns are in dire need of good water.

The Surigao market was finished December, 1912, and occupied January, 1913.

Shipping facilities will be reestablished for the east coast about April 15, when work will be resumed on the school buildings that were left unfinished the previous year.

Until more labor is obtainable, no work will be attempted on the Surigao-Sison Road construction project.

TARLAC.

A recent traffic census of five days' duration on the Tarlac-Victoria Road showed an average daily traffic of 200 carts, 60 carromatas, and 55 automobiles. This heavy traffic for the past three months, together with the continued drought, has been a rather severe test on the road which has a gravel surface with a clay binder. Though considerable dust has developed, only 3 kilometers show any great deterioration and these were built three years ago. They will probably require resurfacing next year.

A recent traffic census of three days' duration on the Gerona-Pura Road, an unsurfaced road, shows an average daily traffic of 130 carts and 56 carromatas. This road has become almost impassable on account of the dust and deep holes developed by traffic.

Construction work on a market building in Moncada, a school building in Anao, and 2 reinforced-concrete pile bridges in Gerona is being delayed on account of the difficulty in getting cars for shipping gravel which comes from the gravel pit in Tarlac. All cars are being used for shipping the large crop of rice.

Four kilometers of the Tarlac-Gerona Road are practically complete. Four hundred and fifty lineal meters of this is bituminous bound as protection against scour from floods. Union road oil, to the extent of 2½ gallons per square meter, applied by the penetration method, was used for this work.

Surveys and estimates have been made for a road from Camiling to the Pangasinan boundary. This road at present will serve only as an outlet for the town of Camiling, but ultimately can be made the connecting link between the road systems of Tarlac and Pangasinan Provinces. Funds are being requested from the Insular Government for this work. Since the Paniqui Railroad washed out this town has been practically isolated for the greater portion of the year. It has a population of 30,000 and is located in an exceptionally rich rice country, much of which is irrigated. It has nine reinforced-concrete barrio schools, a hardwood intermediate school, and has recently secured approximately ₱52,000 for the construction of a market and presidencia, which will be begun in the near future.

TAYABAS.

A double 9-meter concrete girder bridge has been completed by administration on the Sariaya-Laguna boundary road.

Morong Barrio School, plan No. 2, Bureau of Education, has been completed by administration under supervision of a native foreman. Labor ₱0.80 per day, carpenters ₱2.50 per day, bull carts ₱2.50 per day. Total cost, including supervision, ₱3,817.91.

This office has passed upon plans for electric-lighting plants for Lucena and Lucban. Both plants are now under construction.

No bids being received for installation of Boac waterworks system, same will be constructed by administration. The pumping unit will be capable of delivering 40 gallons per minute against an effective head of 85 feet.

A survey of 150 kilometers to develop roads in southern Tayabas has been ordered. This survey will open up and develop a wonderfully fertile coconut country.

The construction of Calumpang Barrio School, plan No. 3, Bureau of Education, has been started by administration under a native foreman.

Lucban School, plan No. 10, is being constructed by administration under a native foreman.

Plans are being prepared for concrete markets for the towns of Sariaya, Pagbilao, Atimonan, and Lucban.

Both the railroad and this Office find labor very scarce. Laborers from five tribes from five different parts of the Islands are working upon one job alone.

ZAMBALES.

The provincial board has authorized the Director of Public Works to advertise for bids for the construction of Loñgos Bridge, Santa Rita Bridge, and two Dalayap bridges on the San Felipe-Botolan section of Subic-North Boundary Road. These structures will be of reinforced-concrete pile bents with a total span of 78 meters, and will be the first of this type to be constructed in this province. This is the type of bridge best adapted for this part of the country.

A big step toward road improvement has recently been taken up by the provincial board when they requested a loan of ₱100,000, payable by annual installment within a period of ten years. If this amount is approved, it is intended to be spent for the construction of the remaining culverts and bridges ranging from 12-meter to 49-meter spans on the Iba-South Road. The district engineer estimates that with the above amount on hand the construction work (bridges) in the south can be completed during the year 1914, and touch the north with the regular road and bridge fund available in the same year. Then by 1915 bridge construction in the north can be taken up in earnest, and at the same time initiate in the construction program the building of a first-class road in the province, which should start from Subic toward the north.

Up to this time practically all the work has been confined to the southern part of the province. This condition of affairs looks like an injustice to the northern taxpayers, and they should not therefore be blamed for their continuous "kicking" about it; but it should not be forgotten that at present more products are raised in the south, and, wherever this is true, the need for better means of transportation is also proportionally greater; wherefore road improvement should be done in the latter place first. This rather impertinent (on the part of the writer) statement is very well illustrated by the fact that the boats that come to trade in Zambales do not go any farther north than the town of Iba. The construction work that may be done in the north will be a sort of development project.

ADMINISTRATIVE CONSTRUCTION OF THE UNIVERSITY HALL, UNIVERSITY OF THE PHILIPPINES, MANILA, P. I.

By J. McGregor,
Chief, Building Division,
Member Philippine Society of Civil Engineers.

[See title page for building under construction February 15, 1913.]

Proposals for the construction of the University Hall to be built on Calle Padre Faura, Ermita, Manila, were opened on April 27, 1912. The lowest bid was ₱170,000 for the building complete, minus electric wiring and fittings, the time being three hundred and sixty calendar days. The highest bid was ₱249,000, and required four hundred and fifty working days.

For various reasons it was not deemed advisable to award the contract to the lowest bidder, and after a considerable quantity of correspondence, bids were again opened on July 27, 1912, for the same work. The specifications were almost identical with those originally advertised, but the plans were slightly changed and a distinct time limit was required of three hundred calendar days. To this latter advertisement three bids were received, the lowest being out of order as four hundred days were required in contravention of the clause of the specifications that only permitted three hundred days. The next highest bid was ₱219,000, the bidder agreeing to complete the building within the three hundred days stipulated. The money already expended on the plans and specifications, and the further sum that would be required for details, together with the electric lighting, installation, inspection charges, and miscellaneous expenses, brought the total cost of the building to approximately ₱273,800. As the appropriation only permitted the expenditure of ₱250,000 for the entire building, including plans and specifications, and Bureau surcharge, etc., it was decided to construct the building by administration.

On August 1, 1912, authority was received from the Secretary of Commerce and Police to construct the University Hall by administration, and active work was commenced on August 12, as soon as the equipment and men could be gotten together. Wherever possible, it was deemed the best policy to subcontract work so long as the amounts bid by the subcontractors were within reasonable limits and the office-estimated cost. The contract for structural steel for the building was let to the Atlantic, Gulf and Pacific Company; the contract for the doors and windows—in fact, all woodwork—was let to Mrs. Jane D. Loper; the contract for the plumbing was let to Mr. Henry Musser; the contract for the granolithic tile work was awarded to Messrs. Machuca Barretto & Co.; and the electric installation to Messrs. Germann & Co. The balance of the work was carried out by pure administration, which also included all the heavy timber construction in the roof, and the erection of the structural steel.

The building is 58.35 meters long by 25.80 meters wide, and consists of three floors and an attic. The frame work is of structural steel framing, encased with reinforced concrete.

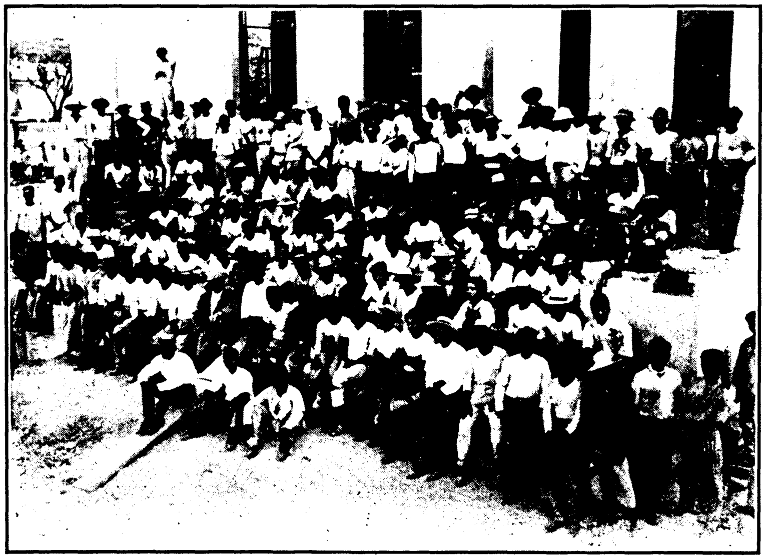
Prior to construction operations being commenced, bearing tests had been made upon the site of the building, producing satisfactory results which have been amply corroborated by observations taken during the course of erection of the building. The foundations were commenced on August 12, 1912, and consist of chain footings of reinforced concrete, dwarf walls assisting to support the framing of the first floor, and distributing weight over the footings. The exterior of the building was ornamented with 10 columns on the front facing Calle Padre Faura, and 6 columns at either facade of the main entrances. The columns were 86 centimeters in diameter at the base, and tapered to 74 centimeters at the cap. The columns were 7 meters 60 centimeters in length from their base to the base of the cap and were 9 meters and 20 centimeters in length over all from base of pedestal to crown of cap. The capitals of these columns were Ionic, and photograph No. 2 shows these caps in detail.

Construction work proceeded every day including Sundays and holidays up to Christmas, the 25th of December being declared a holiday. The work was again continued on the 26th of December, and was carried through up to the Easter holidays, when the religious festivals caused a shutdown of three days.

The construction plant consisted mainly of a Smith No. 2½ concrete mixer, with the contingent elevator and shutes. The title-page illustration shows the location of the mixing plant and its method of operation. Four dumping cars were used for conveying the material from the stock piles and cement shed to the mixer hopper, working in pairs. A proportionate part of gravel and sand were placed in the cars, gravel first, and then the required amount of cement was placed on the top. One car made one batch, and was hauled up the inclined track to the hopper. Dumping it into the hopper caused the cement and sand to get in first, followed by the gravel, in which manner they emerged from the hopper into the mixer. Four minutes were allowed for mixing each batch. It was then dumped into the elevator bucket, hoisted to the desired elevation, and dumped on to the shute platform. This platform was cantilevered on the side of the elevator, and had three permanent openings with three permanent shute shafts attached. For the first and second floors the shutes were supported on frames, but for the third floor and corridor roofs the shutes were suspended from cables. It was found that a batch of concrete took five minutes from the time it left the stock pile to the time it got in the forms, and the highest showing for a nine-hour day was 86 barrels of cement (class A concrete).

On account of working on Sundays and holidays, it was found that night work was unnecessary, and the only night work in the entire building was the troweling down of the cement finish on the floors. All three floors have cement finishes that were poured at the same time the main slab was placed, and took from six to eight hours to trowel down to a finished surface.

The class of native labor was more or less satisfactory. Laborers received 10 cents an hour, Filipino carpenters from 17 to 22 cents an hour, Japanese carpenters ₱3 a day, masons from ₱1 to ₱2 per day, and blacksmiths from ₱1.75 to ₱2.50 per day. During the early part of the construction carpenters were only employed on form work, and a system of having 1 Japanese carpenter with 2 Filipino helper carpenters was tried out. It was found, however, that the Filipino carpenters generally looked on at the Japanese working. It was thought at first that the native carpenter was absorbing the idea of the work from the Jap, but after a week or so it was found that it was more economical to have 1 Japanese carpenter with 1 helper, and, in fact, for the finishing work, it has been found that 3 Japanese carpenters with 1 native helper is the most economical method of hanging doors and windows, and doing general finishing work.



Engineer and men—Americans, Spanish, Japanese, and Filipinos—who did the work.

Details of column capitals and portico cornices, March 15, 1913.

The highest number of men employed was during January, when some 85 native masons, 74 Japanese carpenters, 38 Filipino carpenters, and 13 riveters were employed, daily; miscellaneous employees, such as timekeepers, engine drivers, electricians, etc., brought the number to approximately 250 men per day. This was apart from the men employed by the subcontractors for plumbing, electric lighting, and doors and windows.

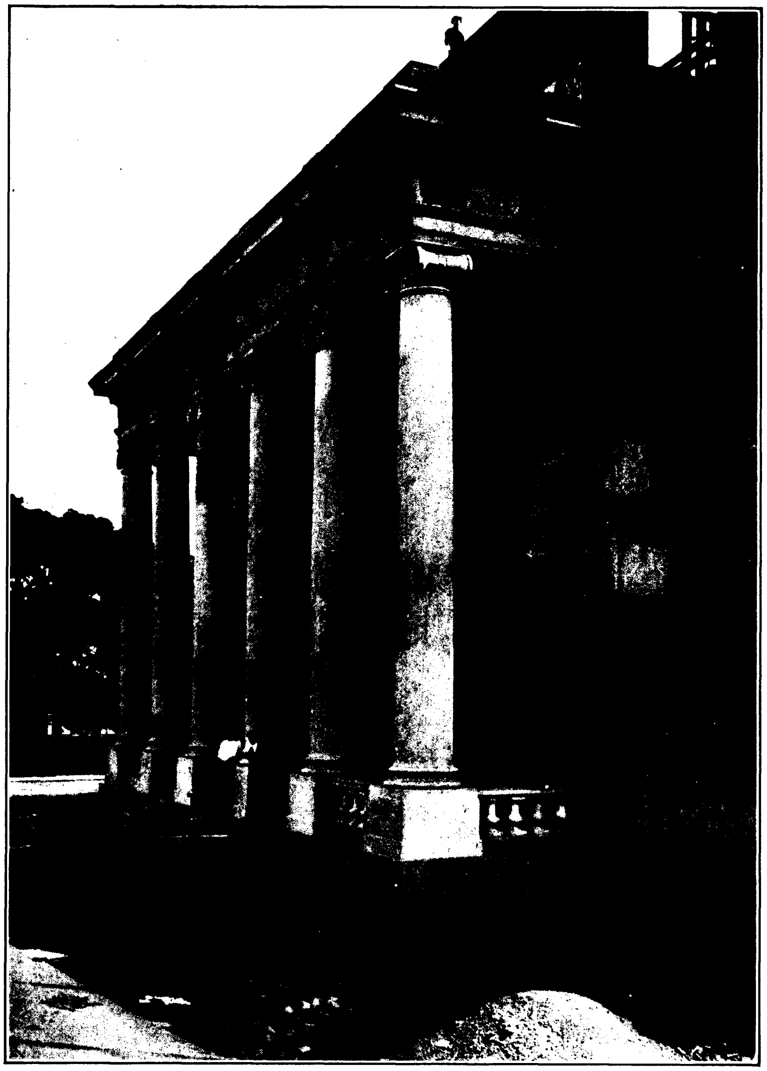
The final batch of concrete was poured on March 9, six months after the date of commencement. In that time 3,755 barrels of cement, 2,237 cubic meters of gravel, 1,476 cubic meters of sand, and 260,800 pounds of reinforcing steel, in addition to 400,000 pounds of structural steel, went into the building.

A word regarding details will probably be of interest. The blackboards of the classrooms, study rooms, etc., were made of concrete, being placed while the walls were green. These blackboards consisted of 1 part sand and 1 part cement, rubbed down to a smooth hard finish with a cast-iron trowel. The resultant surface was beyond what was expected, and has been favorably commented upon by university and other educational authorities. The column caps, which have very delicate lines, were somewhat troublesome to make, the sculptors in Manila having no experience in making a clay model. The model was therefore cut out from a large lump of plaster of paris, and after numerous attempts a suitable model from which negatives could be taken was approved by the Consulting Architect. The cap was poured into a four-piece mold, which, when set, turned out a cap in one piece.

All woodwork in the building is ipil, except the chalk rails of the blackboards, and the staircase handrails. It is proposed to use a stain-proofing compound on the whole exterior of the building to prevent the ipil from staining the concrete. The preparation that will be used has already been tested out by the chief division engineer, the Consulting Architect, and the writer, and shows every indication of satisfactorily keeping the ipil dye out of the pores of the concrete.

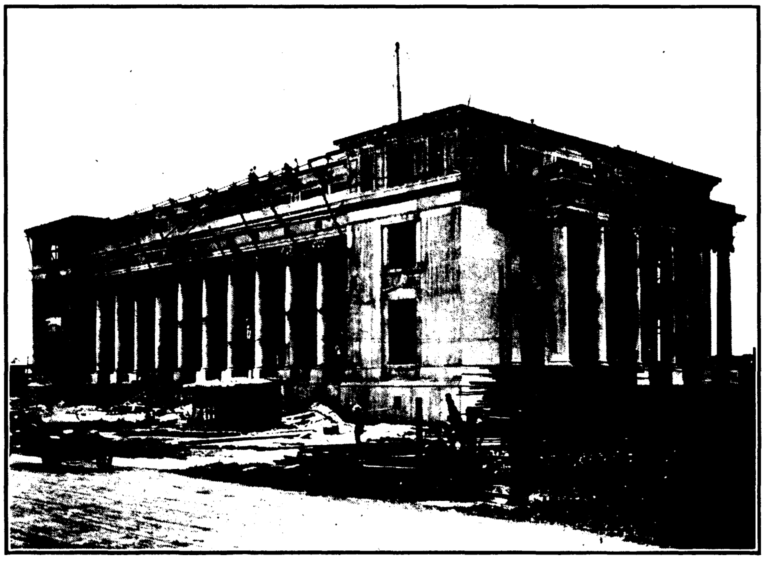
The wrought-iron balustrades and supports are being made administratively, as are also the concrete balustrades in the porticos.

The American force employed was 1 foreman on the job all the time, at a salary of ₱300, and 1 inspector, who also prepared requi-



North main entrance, University Hall, March 15, 1913.

sitions and took out quantities for about 60 per cent of his time. The writer lived on the premises from the time of conmmencement of the construction up to February 1, so that most of the time put by him on the building was outside of office hours. At the time of writing, March 24, the exterior of the building has been finished, the concrete finish of the first and second floors is completed, and doors and windows are being hung throughout the building. The three hundred days expire on June 2, 1913, and the present progress of the work indicates that the building will be completed early in May and within the appropriation.



University Hall on March 15, 1913.

A word regarding the settlement of the building will be of interest in view of the difficulty to obtain suitable foundations for heavy buildings in Manila. The elevations taken on March 15, after the final concrete had been poured, and while the protective sand was still 6 inches deep on the third floor, showed a maximum settlement of 29 millimeters and a minimum settlement of 17 millimeters. The settlement was regular around the entire building, the maximum settlement appearing at either end and the minimum in the dead center.

The bad weather that prevailed during the latter part of the 1912 rainy season retarded the work considerably up to the end of November. During December, however, the force got into full swing and has been working at top speed up to the present time. The work will be rushed through to completion irrespective of the three hundred days, and will most probably be completed by the 15th of May.

The following report sheet shows how unit costs were arrived at and balances of material on hand and amount of material expended kept track of from month to month:

SUMMARY OF REPORT FOR JANUARY, 1913.

Amount of month's pay roll.

Capataces	₱129.64
Carpenters	7,080.20
Masons	2,464.67
Steelmen	271.95
Riveters)	
Blacksmiths	379.39
Machinist	58.68
Watchman	48.33
Laborers	471.28
Miscellaneous	93.00
Total	10,997.14

Items accomplished this month.

Concrete placed:		
1:2½:5	cubic meters	465.23
1:2:4	do	121.84
Total volume	do	578.07
Reinforcing steel (placed)	kilograms	23,940.76
Forms (for concrete)	board feet	37,055
Woodwork (door and window frames)		₱3,876.13
Miscellaneous (general)		₱295.33
Total estimate of work completed this month		₱28,276.09
Total cost of labor to do same		₱10,997.14
Labor for the month	per cent	35
Total estimate of work completed to date		₱126,509.10
Total cost of labor to date		₱38,447.77
Labor to date	per cent	31

Amount of material placed during this month.

Description.	Quantity.	Unit price.	Total.	Unit price in place.
Concrete:				
1:2½:5	456.25 cubic meters.			
1:2:4	121.84 cubic meters.	₱16.53	₱9,556.38	₱16.53 per cubic meter.
Cement	989 barrels	5.00	4,945.00	
Gravel	528.54 cubic meters.	2.35	1,242.07	
Sand	255.70 cubic meters.	1.70	434.69	
Reinforcing steel	23,940.76 kilograms.	.16	3,905.87	₱0.16 per kilogram.
Tie wire	5 coils		3,114.00	
Triangular wire mesh	266.95 linear meters.		163.69	
Forms (for concrete)	37,055 board feet	.253	9,401.38	₱0.253.
Nails	1,028.85 kilograms	.09	92.60	
Woodwork (door and window frames).			4,117.13	
Miscellaneous			295.33	

Approximate amount of material on hand (important items only).

Cement	barrels	584
Gravel	cubic meters	154.66
Sand	do	159.72

The weather during January was 87 per cent good.

Itemized monthly report of operations on University Hall for January, 1913.

Description.	Material.						
	Unit.	Amount on hand.	Cost.	Amount expended.	Cost.	Balance on hand.	Cost.
Cement	Barrels	1,573	₱7,865.00	989	₱4,945.00	584	₱2,920.00
Gravel	Cubic meters	683.20	1,485.20	528.54	1,242.07	154.66	243.13
Sand	do	415.42	560.52	255.70	434.69	159.72	125.83
Electricity, etc					45.00		
Axle grease	Cans	70	15.19	10	2.17	60	13.02
Waste cotton	Kilograms	10	5.82	10	5.82		
Oregon pine, tongued and grooved:							
1 by 6 inches	Board feet	15,000	1,125.00	15,000	1,125.00		
1 by 3 inches	do	10,040	753.00	10,040	753.00		
Oregon pine, rough:							
2 by 4 inches	do	10,007	750.53	10,007	750.53		
4 by 4 inches	do	2,008	150.60	2,008	150.60		
Nails, assorted	Kilograms	2,028.85	182.60	1,028.85	92.60	1,000	90.00
Rope:							
½-inch	do	25.20	10.41	25.20	10.41		
¾-inch	do	52.60	18.25	52.60	18.25		
Steel:							
⅜-inch round	do	2,987	358.44	2,987	358.44		
⅜-inch square, twisted.	do	3,772.07	452.65	3,772.07	452.65		
¾-inch round	do	2,500	300.00	2,500	300.00		
¾-inch square, twisted.	do	2,824	338.88	2,824	338.88		
½-inch round	do	4,392	527.04	4,392	527.04		
½-inch square, twisted.	do	3,000	360.00	3,000	360.00		
1 inch square, twisted.	do	3,298.74	395.85	3,298.74	395.85		
Tie wire, No. 16	Coils	5	31.14	5	31.14		
Triangular wire mesh	Linear meters	1,266.95	816.69	266.95	163.69	1,000	753.00
Door and window frames.			3,876.13		3,876.13		

Total cost of December work	₱28,276.09
Per cent of labor to do same	35
Total cost to date	₱126,509.10
Per cent of labor to do same	31

SUMMARY.

Features.	Cost of labor.		Unit.	Work accomplished.			
				During month.		Up to date.	
	This month.	Up to date.		Quantity.	Unit cost.	Quantity.	Unit cost.
Concrete:							
1:2:4 ....121.84 cubic meters. 1:2½:5...456.25 cubic meters.	₱2,941.63	₱9,493.45	Cubic meter.	578.09	₱16.53	2,043.38	₱17.52
Forms	6,511.00	20,246.02	Board feet	37,055	2.53		
Steel reinforcing	1,008.18	3,085.44	Kilograms	123,940.76	.16	104,406.84	.14
Woodwork	241.00						
Miscellaneous	295.33	1,645.25					

Features.	Value of work accomplished.			
	This month.	Per cent of labor to do same.	Up to date.	Per cent of labor to do same.
Concrete	₱9,556.38	30	₱35,806.23	26
Forms	9,401.38	68		
Steel reinforcing	3,905.87	26	14,740.74	29
Woodwork	4,117.13	5		
Miscellaneous	295.33		1,940.58	

THE AMERICAN ROAD CONGRESS.

By C. E. Gordon, C. E.,
Member, American Society of Civil Engineers,
Member, Committee on Resolutions, American Road Congress.

The American Road Congress was held at Atlantic City, N. J. and was in session from September 30 to October 5, inclusive. The congress consisted in the meeting of the various civic bodies of the United States that were interested in highway development; and national, State, and municipal officials, including highway commissioners and highway engineers of France, Canada, and the United States, who were interested in road improvement and maintenance; and of the American manufacturers of road machinery and road materials.

The congress was called to order by Mr. Logan Waller Page, Director of the Office of Public Roads of the United States, with a few introductory remarks, introducing the Honorable Woodrow Wilson, then governor of the State of New Jersey, and now President of the United States. Governor Wilson welcomed the congress on behalf of the people of the State of New Jersey in a comparatively brief but extremely well-prepared address. Because of the pertinence of a portion of that address to a proper highway policy and believing that President Wilson's views would be of especial interest to the people of these Islands, particularly as the highways here are being developed, the writer assumes the privilege of quoting that portion:

Governor Wilson said:

> *You cannot rationally increase the prosperity of this nation without increasing the road facilities of this country.* I tell you frankly that my interest in good roads is not merely an interest in the pleasure of riding in autos, nor in the much more important matter of affording the farmers a more ready access to neighboring markets, but it is also the interest in weaving as complicated and elaborate a net of neighborhood and State and national opinions together as it is possible to weave. It is of the most fundamental importance that the United States should think ultimately as a whole. In proportion as we are confined within the walls of one hostelry or city or State, we are provincial, and national thought cannot successfully build itself upon those foundations in a way that will be permanent. *So I believe the development of great systems of roads is a task of statesmanship.*

The italics in the above quotation are the writer's. The address indicated the attitude of Governor Wilson toward the development of highways, and it is quite probable it indicates that if President Wilson were here, he would be in enthusiastic accord with the development of the highway system now being executed by the Government of the Philippine Islands. Excellent reasons are given in the address for the construction of interprovincial highways. The fact that the location of an interprovincial road happens to be through a locality which is poor agriculturally, and which is thinly populated and probably will always be thinly populated, should be no barrier to its construction or development. As bearing upon the lack of intercommunication, the writer will repeat a portion of the above for emphasis: "In proportion, as we are confined within the walls of one hostelry or city or state, we are provincial, and national thought cannot successfully build itself upon those foundations, in a way that will be permanent."

The object of the congress was to bring together all those forces that were engaged in improving the condition of the highways, and to obtain concrete expressions from the leading exponents of those forces with a view of adding an acceleration and an improvement to the present development of roads, and to ascertain the views of the leading experts in the various phases of highway development. Experts addressed the congress upon the several methods of obtaining the moneys necessary for highway construction and maintenance, and the economic errors already committed by several commonwealths and municipal governments were discussed. The financial shortcoming which received the greatest amount of attention was the great economic error that has obtained in the past, comparatively remote and surprisingly recent, in the issuance of highway bonds for twenty-five years, forty years, and even fifty years. When it is considered that the bulk of these bonds has been issued for the ordinary macadam road, and when it is a recognized fact, among professional men—engineers—that these bonds are issued for terms that are very much longer than the life of a macadan road, it is very difficult to understand how great political entities, like the State of New York, could be guilty of such an error in financial administration. To be concrete, the issuance of bonds for a project where the life of the bonds is greater than the life of the material result of the project is very bad finance when the bonds continue to draw interest after the work they paid for has disappeared.

Lawyers addressed the congress upon needed enactments and pointed out defects in present legislation. The leading engineers addressed the congress and attracted its attention to the obvious and many defects in the administration of the expenditure of the millions of public moneys. It was generally admitted that administrative shortcomings were general throughout the United States, and that their existence was due to the closeness of politics and public expenditure. Prominent administration officials and engineers of Canada informed the congress of the present highway activity in the Dominion, of the methods followed, and of the future program. The chief of the French Commission of Engineers, now studying engineering matters in the United States and who is also one of the leading engineers of the Corps des Ponts et Chaussées, addressed the congress upon the highways of France. He stated that in France the people are taxed upon a use basis. For example, if a large factory were to be operated near a road, its tonnage over, and use of, the road or roads would be studied and the factory taxed upon the tonnage. This is simply the application of the principal "the greater the use, the greater the cost." This principal is established in England as may be noted from the recently decided case of the Billingham rural district council against the Darney Quarry Company of West Woodburn. To some extent the application of this principal has gained definite lodgment in several of the American States and at the present writing it is very probable that a limited application of the principle will become general. It has become a fact that roads which could withstand the traffic of a decade ago cannot withstand the traffic of to-day. It is a fact that the kind of traffic has changed very materially during the past ten years, and from statistics gathered for 1912 the present conditions are far from the ultimate change. The writer hopes to be able to illustrate with data obtained from Europe and various States of America, in a subsequent article, how traffic has changed; how it is changing; and the relationship existing between increasing motor traffic and the increasing cost of highway maintenance. The present data apparently prove conclusively that the increase in maintenance costs is due to the motor vehicles and, therefore, the motor tax laws are supported with facts.

Nearly all the States were assigned booths in which were exhibited excellent articles, illustrating their activity in highway development. Each booth was in charge of an engineer in the employ of a State or one of the State highway commissioners. His function was to explain any of the articles illustrated and to distribute such of the literature that might be desired by the caller at the booth. Plans of highway construction; State highway maps; standard plans of structures; route maps; standard specifications; materials of construction, such as broken stone of the different sizes, gravel, and sand of the various grades; cross-sections of standard form, constructed from real, standard materials, illustrating the several forms of construction—telford, macadam, bituminous macadam, mixed and penetrated; standard profiles; photographs of assorted sizes showing the various highways and structures; and books of record were among the articles shown.

The writer is aware that it is not good form to bestow praise upon an organization to which he has the honor to belong; however, he happens, in this event, to be the only person in the Islands qualified to utter a comparison and, therefore, he will accept the risk of being charged with poor taste and request the indulgence of the reader. The writer regretted exceedingly that the Government of the Philippine Islands, through the Bureau of Public Works, did not possess a booth and that its exhibit at the Philippine Carnival was not shown. No criticism is intended, as the period between the date of notice and the date of opening of the Congress was too short to permit an exhibit to be shipped and shown. This Bureau possesses a structural, a pictorial, and a statistical exhibit far superior to any of the exhibits at Atlantic City. However, it is proper to add in reference to the United States Office of Public Roads, that its functions are educational and experimental, whereas the chief functions of this Bureau are administrative and constructive and, therefore, opportunities and conditions are produced not within the scope of the functions of the United States Office of Public Roads. The Office of Public Roads, however, had a most excellent educational exhibit; it was the center of much interest and was arranged very compactly and attractively. It exhibited with actual materials the Roman road construction and the original telford and macadam types of construction, together with modernized macadam and bituminous macadam construction. The sand-clay road and a properly built and maintained earth road were also shown. These illustrations were exhibited upon a platform, circular in form, with the center raised about 4½ feet and the edge about 2 feet from the floor.

The road-machinery exhibits were particularly good and comprehensive. The exhibits embraced nearly all of the latest designed road rollers and scarifiers; stone crushers; asphalt and concrete mixers; light and heavy oil distributing wagons; bituminous heaters, large and small; small distributing apparatus for heavy bituminous materials; quarry machinery; and large batch mixers, suitable for mixing bituminous concrete and ordinary cement concrete for concrete roads and pavements. Several of the companies manufacturing patented pavements had very attractive booths. Among those may be mentioned the Amies Road Company of Easton, Pa. The name of this product is "Amiesite" which is a bituminous concrete. Broken stone or gravel is first made clean through being sprinkled with ammonia, then the stone is heated and mixed with a heavy asphaltic oil and lime. The mixture of oil and lime is the basis of the patent. The resulting concrete possesses a quality which does not require it to be placed at once in a pavement. The writer inspected a State highway near Rochester, N. Y., which had been paved with this material during the month of October and after it had been mixed for from two to three weeks. This inspection was made in company with the resident engineer in charge of that portion of the State of New York who expressed his satisfaction with the material. From close observation on the part of the writer, he was very favorably impressed with the article. For a mixed bituminous concrete pavement, Amiesite appears to be giving general satisfaction. It possesses the quality which permits of its being manufactured at a central plant and of being transported by railway over comparatively long distances without apparent deterioration or serious hardening.

The Warren Brothers Paving Company had an excellent exhibit of bitulithic pavement, and as this pavement has had such a wide and general application, and has been upon the market for several years the writer will assume that the reader hereof has made its acquaintance and, therefore, no additional remarks thereon will be made. The same company manufactures a paving material similar to Amiesite and known as "Warrenite." As sufficient time has not passed since the introduction of this paving material to establish its action under use, to state an opinion at this time would be to presume a conclusion and, therefore, the writer is obliged to confine himself to a descriptive reference only.

The Dollarway Paving Company had a very attractive exhibit. This pavement had not been patented when the writer was in the States and it was understood that the applicants for a patent were meeting with considerable opposition. The pavement consists of a concrete base of more or less thickness, thinly covered with a bituminous coat and sprinkled with clean, course sand, fine gravel, or clean screenings of hard broken stone. The usual depth of the top coat is about one-fourth of an inch. This type of pavement is becoming popular in the United States and has a very promising future. The writer hopes to be able to discuss this pavement at greater length in a subsequent article wherein the various costs, and adoptions, and durabilities, will be treated.

A very interesting booth was that occupied by the Robeson Process Company of New York. The material exhibited by this company is known as "glutrin." This seems to be a by-product from the sulphite paper mill. It is a thin material, resembling water, and can be applied without heating, by an ordinary street water sprinkler. It appears to harden a gravel or broken stone pavement, and in particular a slag pavement, very quickly after application. The amount to be applied per square yard, as recommended by the manufacturers, is about one-half gallon for macadam construction, and about one-tenth gallon per annum for maintenance. Because of its solubility in water this material has not given satisfaction in some of the states and particularly so in the experiments made by the Ohio State Highway Commission, the opinion of which may be noted on pages 3 and 5 of Bulletins 13 and 15, respectively, of the Ohio State Highway Commission. In October, State Highway Commissioner McDonald of Connecticut was an advocate of the use of glutrin covered with a bituminous oil. From an examination of the Connecticut roads the writer was unable to observe any superiority due to this product. As the manufacturers quoted the writer a price of 24 cents, f. o. b. steamer New York, or 28 cents including the wooden barrels, and because of the very long rainy season obtaining here, and the consequent total loss per annum as a probability, the writer would certainly prefer a less soluble material or a heavy bituminous material to glutrin. This company showed the writer a section of State highway treated near Atlantic City wherein the road metal was run-of-bank gravel. This road was in very good condition.

A certain booth which received much attention from engineers and representatives of State highway commissions was that of the Concrete Guard Rail Company of Rochester, N. Y. A very large item in the maintenance of the State highways is the guardrails placed over the ends of culverts and along the tops of high embankments for protection, these being constructed of wood requiring painting and replacing after a term of years of more or less extent. The amount of the item of expense being so large the necessity for a permanent guardrail became apparent and the above-named company, obtaining a patent upon a guardrail, entered upon their manufacture. The dimensions conform to the sizes specified by the New York State Highway Commission. This State commission now requires that all guardrails be constructed of concrete in the future. These rails and posts are made of 1 : 2 : 4 gravel concrete and 29 linear feet thereof weighs a short ton. To manufacture the rails at distances more or less remote from Rochester, the company is prepared to furnish and ship molds so that the product can be made at the side of any road job.

In the booth of the State of New Jersey there was a very attractive guide sign and guide post. These signs are met with generally throughout New Jersey and somewhat in the State of New York, and their neatness in design and uniformity places the State of New Jersey, in the opinion of the writer, far in the lead of all the States in this particular.

The State of South Carolina was unique in exhibiting a new route book of a size 13 by 23 centimeters, which will permit of its being carried in the coat pocket. The book contained detailed maps of the large towns, showing thereon the through route, the hotels, the gasoline depots, and the road markers. Upon the face of the interior of the book, the left page contained a map of the through route drawn accurately to a scale of one-fourth inch to 1 mile, showing the railways, villages, distances, hotels, telephone and telegraph stations, streams, drinking wells, villages and instructions at turns. Perhaps the reason for the introduction of the route book would be better told if the words of State Commissioner Watson were used. Mr. Watson states:

> With the steadily increasing use of motor vehicles for agricultural and commercial purposes has therefore come an ever-increasing use of the public highways of the Commonwealth, a similar demand for improved highways, and a still more pressing demand for accurate information in regard to these highways.

The organization to which the writer has the privilege to belong was honored in his having been appointed a member of the committee on resolutions of the congress. The principal resolution submitted to the congress, and which was adopted, was one recommending Federal aid in the construction of national roads. The question of national aid was before a Senate committee when the writer left Washington.

The congress may be criticized for not passing certain definite resolutions as to pavement, paving materials, load units, and specifications. As to pavements and paving materials, the introduction of bituminous and concrete highways is so recent, and the data thereon so uniform and indefinite, that no resolutions could have been passed except a set closely following those passed by the International Road Congress at Brussels in 1910, or a resolution officially adopting the Brussels resolutions. The present is still a period of study, experimentation, and trial. The present period is quite similar to that of about twelve years ago as to reinforced concrete, or that of about seven years ago as to prime movers. The condition may be noted from the writer's previous reference to glutrin. The authorities of Connecticut consider it an excellent article when, at the same time, authorities of some of the sister States regard it with disfavor. The writer feels that the congress should have made definite recommendations as to the unit to be adopted to determine the load on a pavement. As it is, the knowledge of the load is chaotic. The Corps des Ponts et Chaussées have a unit called a "collar" which is better than no unit. If an investigator is to study a prime mover he can very readily determine the load and obtain the efficiency of the engine at one-fourth, one-half, three-fourth or full load. If the engine is a new one, the purchaser can purchase upon specified efficiency as a basis, and the amount of work that the engine is capable of doing may be known before a penny of payment changes ownership. With pavements very little is shown as to the amount of traffic they will carry, and less is known as to what they have carried and, consequently, data as to their durability are purely opinionated or conjectural. It is plain that to obtain a definite knowledge of the load a constant observation throughout the twenty-four hours for several years will be necessary and, consequently, it will be more or less costly to obtain. In no other way can definite knowledge be obtained. It took England several years to determine the suitability of the stone for the Houses of Parliament, and those in charge of the Washington Monument, in the beginning, could have profited greatly if a longer period of stone study had been taken.

Maj. W. W. Crosby, of the State Roads Commission of Maryland, recognizing the chaotic condition as to load has recommended a unit using the foot as a basis. Additional impediments may be found in the opposition of the various legislatures, city councils, and civic commissions for the continual appropriation of money for necessary scientific investigations.

In the writer's judgment the congress could be criticized in failing to make the tests of bituminous materials standard. At present it is rarely that specifications originating from two sources are identical. For example, the specific gravity is specified to be a certain amount relative to water at a certain temperature in one specification, and of so many degrees of Baumé in another specification, which requires a mathematical calculation to obtain the equivalent.

No quotations are made from the numerous papers presented, or speeches delivered, or discussions uttered for the reason that these have been appearing in the various technical periodicals of the past several months and consequently it is assumed to repeat any part of them here would be a repetition of previously read matter.

The writer is very much pleased to note the concensus of opinion obtaining among all as to the necessity for better gradients and alignments of the improved highways. In a recent report of the Highway Commission of the State of New Jersey it was admitted that a lack of foresight on the part of those responsible for the improvement of the highways of New Jersey in the past was manifest in poor gradients and poor alignments. The present authorities, at increased expenditures, are improving the grades and alignments, for it is recognized that the motor vehicle is here to stay; that in number they are increasing rapidly; that they move with speeds approximating to, or a little less, than railway trains, and that poor alignments jeopardize life to a greater extent than good alignments. The editors of the leading technical periodicals are advocating the improvement of alignments and grades and the most progressive bodies are requiring superelevation upon the curves. It is not a question of absolute safety; it is a question of improving the highway so that the chance of an accident may be reduced to a minimum, and surely absence of signs, poor grades, flat and sharp curves increase the probability of accidents. The age demands speed and the motor traffic is increasing. No one will dispute the statement that it is safer to travel in a railway carriage at 25 miles per hour than at 50 miles per hour; but, how many would care to travel from California to Chicago at the slow rate. The public demands the greater speed and consequently is content with the greater risk. To obtain the greater speed the railways have mounted signs, reduced the degree of curvature of the curves, made easements at the points of transition, and increased the lengths of the grades and the vertical curves. As the railway developed, so is the highway developing.

In conclusion, the writer wishes to state that a large road congress is an ideal place to obtain knowledge of what is being accomplished throughout the territory and upon the subject embraced by the congress, and consequently no better place could be found in which to begin an investigation relative to highways. For example: The manufacturer exhibits his latest and best machinery or material and an inquiry brings out the knowledge of where they are being used. It then requires a trip of more or less extent to see the machine or the materials being used and placed. The great good arising from all congresses of this nature is the dissemination of the latest and best knowledge and practice and from their increasing frequency it seems that great benefits are being obtained in engineering, medicine, law, theology, and the arts. A congress is an ideal instrumentability for the harmonizing of thought; it is an excellent unifier of correlative ideas; and a great disseminator of civilization's leading information.

PHILIPPINE SHADE TREES AND ORNAMENTAL PLANTS—THEIR PLANTING AND CARE.

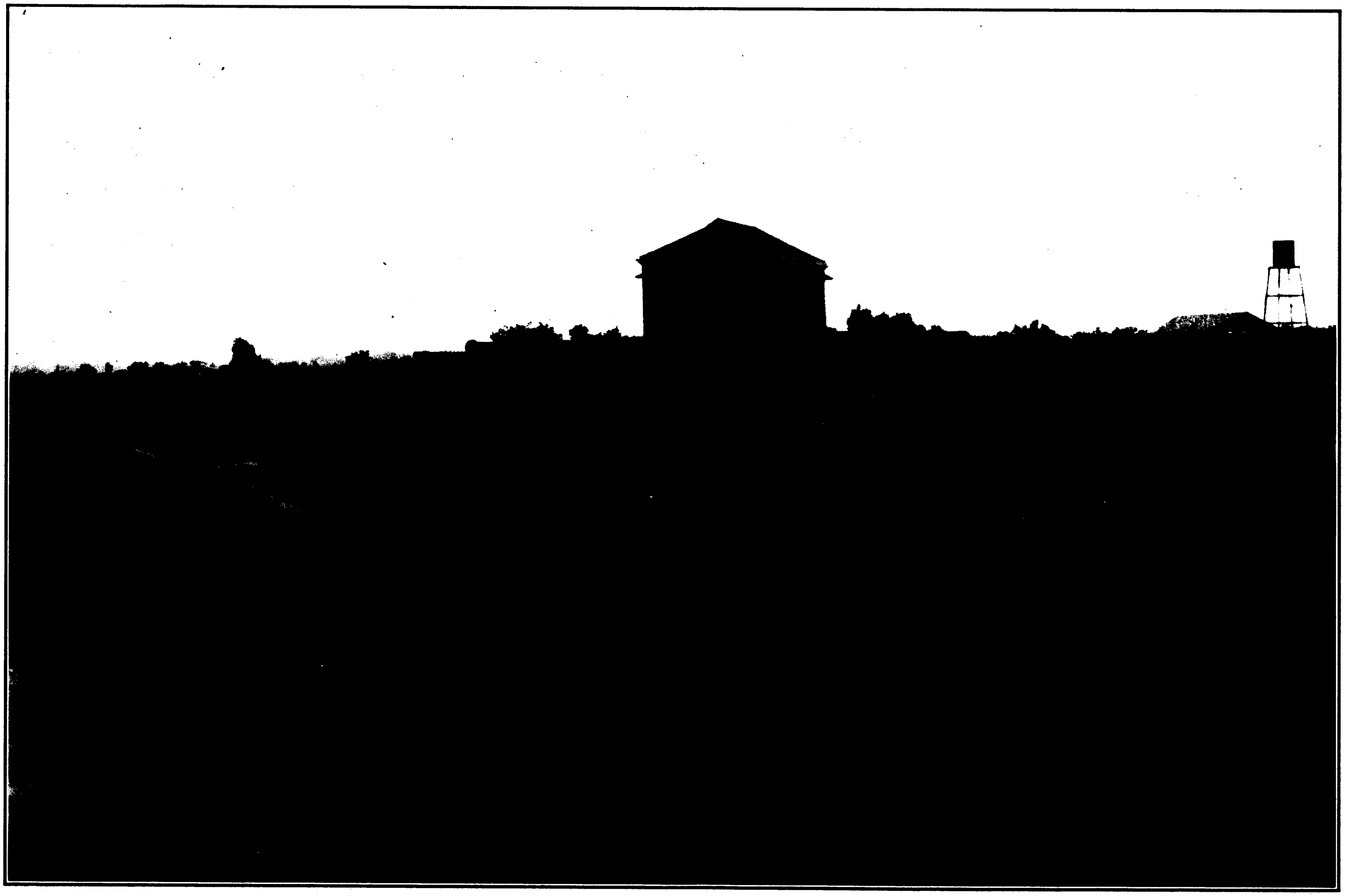
By E. D. MERRILL, Botanist, Bureau of Science.

In the compass of this short article it is useless to attempt a general discussion of the merits of shade trees. Their utility, in all civilized countries, is very generally recognized, and while the desirability of shaded roads is admitted in most temperate regions, curiously in this tropical country, where the need of shaded streets is immensely greater than in temperate regions, the subject of tree planting along country roads has received scant consideration. It is quite impossible to overestimate the value of well-shaded roads, but these can be secured in the Philippines only by well-planned and persistent effort.

On country roads, especially the system of first-class provincial roads now being constructed and maintained in the Philippines, tree planting is essentially a function of the Government, not of the individual. The selection, planting, and care of shade trees should be under the direction of competent individuals who should be in a position to enforce uniformity in the selection of species, distances at which they should be planted, and other matters. This might be one of the functions of the district engineer.

At the present time there are definitely known in the Philippine Islands approximately 2,500 different species of trees. With this great number to select from an uninformed individual might form the opinion that suitable shade trees can readily be had and in indefinite quantities. This however, is not the case. Among the great number of tree species, native or introduced, the list of those suitable for extensive planting is limited to from 12 to 15 species at most. The only place in the Philippines to-day that can boast of an adequate supply of well-formed trees for shade and ornamental purposes is the city of Manila. This is due to the persistence and foresight of Mr. J. C. Mehan, under whose inspiration and direction the city nursery at the Cementerio del Norte was established.

Primarily, trees planted along streets are for shade purposes, and a good shade tree must have certain very definite qualities. The first essential is that the tree should be evergreen—that is, it should retain its foliage through all months of the year—or it should at least possess the quality of producing fresh foliage immediately after the fall of the old leaves. The second essential is that it should have a spreading crown, not a narrow erect one, or one of pyramidal or conical form; the trunk should be upright, with a clear length of at least 4 to 5 meters to the first branches when the plant is mature. Other essential considerations are that the plant should be strong enough to withstand the ravages of typhoons, and should have a



Provincial building and grounds, Tarlac, Tarlac.

powerfully developed root system; it should have small or medium sized leaves and small fruits; and it should be of rapid growth. Other things being equal, trees with attractive form, foliage, and flowers, and so far as possible immune from the attacks of insects, should be selected.

A tentative list of desirable shade trees for the Philippines, mostly suitable for all altitudes from sea level up to about 1,000 meters is as follows:

Enterolobium saman: The rain tree, here popularly and erroneously known as "acacia."

Tamarindus indica: The tamarind (Sampaloc, Salomague, sambac).

Canarium ovatum: The pili.

Mangifera indica: The mango.

Peltophorum ferrugineum.

Cassia siamea: This and the preceding, both with showy yellow flowers, popularly and erroneously called "acacia."

Diospyros discolor: The mabolo or camagon.

Sandoricum Oetjape: The santol.

Parkia timoriana: The cupang.

Albiszia lebbeck.

Calophyllum inophillum: Palomaria.

Heritiera littoralis: Duñgon late.

Decorative effect (*Bougainvillea*), various shrubs and Royal Palms (*Oreodoxa regia*).

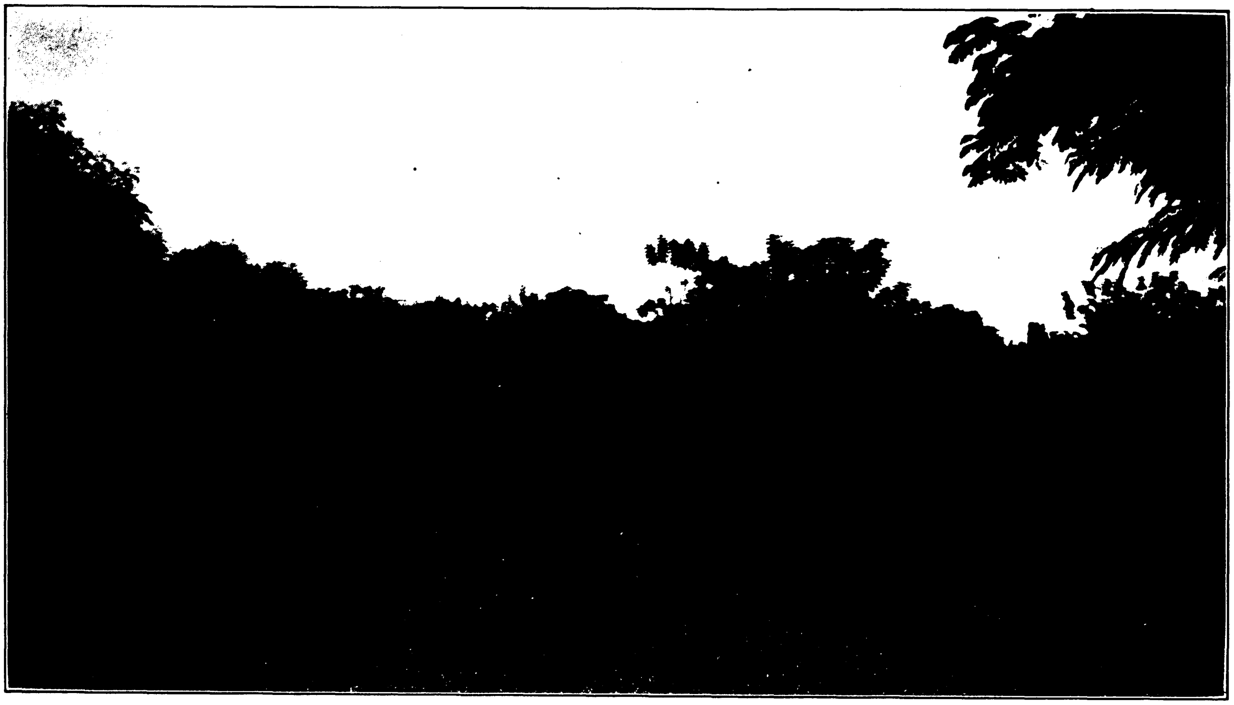
All the above species fulfill most of the essential conditions indicated above for shade trees suitable for planting along streets and avenues, both in urban and in rural districts. To some there are objections of one kind or another, but any street or avenue planted with any one of the above species, will, on maturity of the trees, reflect great credit on the individual responsible for the selection, planting, and care of the young trees.

Of the above list, the rain tree (acacia) is *par excellence* the one tree best fulfilling all the indicated characters of a first-class shade tree. The tamarind has the disadvantage of rather slow growth; the pili, in not being available in all provinces, and perhaps being adapted only to certain regions, such as those provinces like Tayabas, Camarines, Albay, etc., where it naturally thrives; the *Peltophorum* and *Cassia,* in not being available outside of the larger cities, and even then, in small quantities; the mabolo, in being of slow growth and in having a narrow crown; the mango, in having a comparatively weak root system, and, with the santol, having the inherent disadvantage of all fruit trees—that is, subject to injury from irresponsible individuals in their attempts to secure the fruits. The *Albizzia* is not generally available and is deciduous for quite a long period at least in those provinces having a long, dry, hot season. The Palomaria and duñgon late are of slow growth, and have been added on account of their eminent adaptability to one habitat—that is, for roads along the seashore. Both are essentially coastal trees and will not thrive away from the sea. The cupang has not been utilized as a shade tree in the Philippines, but is admirably adapted to this purpose, especially in view of its majestic size when mature.

Trees planted along streets and roads may serve a double purpose. That is, in addition to providing shade, species for planting may be selected with a view to their economic value. For example, in parts of Europe fruit trees are planted along public roads, and the crops of fruit each year are auctioned by the municipalities; in parts of India the mango is planted with the same end in view; and in Uganda rubber trees are so planted. In the Philippines rubber trees cannot be considered for shade trees on account of their comparatively weak structure, being easily broken by typhoons. However, desirable trees for shade purposes, and at the same time of economic value for their fruits, are the mango, the tamarind, the pili, the mabolo, the santol, and the lumbang or biao.

Outside of Manila there is probably not a single locality in the Philippines where a sufficient

Driveway, alternating royal palms (*Oreodoxa regia*) and trees (*Cassia siamea*).



A lawn with decorative shrubbery.

number of any one of the above species of suitable size can be secured for planting any considerable length of road. This being the case, if the first-class roads of the Philippines are to be properly shaded, it will become essential to establish in various regions nurseries for the propagation of desirable shade trees. It is very probable that arrangements can be made in school gardens, and already in some provinces (Laguna, for example) nurseries for the propagation of useful trees have been instituted by the schools.

A small nursery is really a very simple affair, and does not need a great deal of attention. The ground selected should be rich, well drained, and shaded, and should be thoroughly spaded up for the seed bed. Seeds should be planted in rows, and should be watered from time to time. When the young plants are from 15 to 20 centimeters in height they should be transplanted into rows, the rows about 1 meter apart, and the plants 30 to 40 centimeters apart in each row. In transplanting about one-half or two-thirds of the foliage should be removed to offset the damage to the roots, and the plants should be thoroughly watered. It is needless to state that the nursery should be thoroughly fenced. Plants from 1 to 3 meters in height are of suitable size for transplanting to their permanent places—in parks or along streets or roads.

Transplanting to the street or avenue should be at the beginning of the rainy season. Do not wait until the rainy season is well advanced, for in order to thrive the plants must be well established before the advent of the dry season. The most essential condition is that the soil should be very moist. *Do not attempt to transplant trees or shrubs in the dry season.*

It is very important, especially in poor soils, that sufficiently large holes be prepared for the young trees. For trees 1 to 3 meters in height the holes should be at least 0.7 meter in diameter and 0.5 meter deep preferably larger, and for larger plants they should be proportionately greater. Surface soil containing organic matter and, if available, some manure or other fertilizer should be used in filling the hole when the young tree is placed in position. It is essential that the soil be very firmly pressed or tamped about the roots of the tree. The soil level on the transplanted tree should be the same as in the nursery; *under no circumstances should the tree be placed deeper in the ground than it originally grew.*

In transplanting, the top of the young tree should first be thoroughly cut back in order that transpiration can be checked in correspondence with the injury to the roots. Most of the leafy branches should be removed, or if the branches be not developed then most of the leaves. Whenever possible a ball of earth should be removed with the young tree, which may be held in position about the roots with gunny sacks, if necessary. The ground should be thoroughly wet before attempting to remove the young plants. In light sandy soil it is frequently difficult to remove a ball of earth with the roots of the plant being transplanted. In this case, however, the roots should never be exposed to the wind or sun, and should immediately be "puddled" on removal from the ground—that is, immersed in clayey mud of the consistence of thick paint. This treatment is especially valuable when plants have to be transplanted some distance, as it protects the roots from the air. Young plants should be thoroughly watered on being transplanted, and for a few days should be shaded with

Driveway decorated with royal palms (*Oreodoxa regia*) and various trees.

a screen of coarse grasses or bamboo, or at least a few leafy branches so placed as to protect the plant from the direct rays of the sun.

Even large trees may be transplanted very readily if care is taken not to expose the roots to the sun or wind, and if the top be cut back very thoroughly. Rain trees up to a foot or more in diameter may be transplanted with safety, provided the entire top be removed and the freshly cut surfaces painted over with tar or paint. Do not be afraid of cutting the tree back too much. Better remove all the branches than not enough. *Failure in transplanting trees is more frequently traceable to insufficient pruning than to any other one cause.* The crown must be reduced sufficiently to reduce the transpiration commensurate with the injury of the roots in transplanting.

Some kind of protection to the young plant is absolutely necessary to guard it from grazing animals, irresponsible individuals, etc. The most economical and at the same time a thoroughly satisfactory fence can be made of bamboo, and should be about 1 meter in diameter and at least 2 meters in height. It is useless to plant trees and expect them to thrive without giving them some care and attention at least for the first year. Camineros should be instructed to keep the fences about the young trees in repair, and to eradicate all grasses and other herbaceous plants within an area of at least 1 meter in diameter surrounding each tree.

Driveway (*Bougainvillea*) on trellises to right and left.

As the proper planting and care of shade trees along public roads is of great importance it is urged that *all planting of shade trees be confined to a single species* at least for reasonable distances. Never plant trees promiscuously, without regard to species, and do not "alternate" species. The best results are to be obtained by the use of a single species, not by "mixing" or "alternating" different ones. The holes for receiving the young trees should be prepared before the plants are removed from the ground. The trees should be located behind the ditches, and not on the graded margin of the road, and preferably 3 to 5 meters from the edge of the road. Planting should be done at the beginning of the rainy season. Trees for permanent shade should never be planted less than 15 meters apart, and for the rain tree (acacia) 25-meter intervals is better than shorter distances. It is only permissible to plant closer than 15 meters apart when it is the intention later to cut out every alternate tree as they develop in size. Young trees must be properly protected against cattle by tree guards or by fences. Promiscuous cutting of branches by unauthorized individuals should be strictly prohibited, and the construction of nipa houses in close proximity to shade trees should not be permitted.

On account of the variation in climatic conditions in the Philippines, seasonal distribution of rain fall, different geologic formations, etc., the distribution of dry hills, fresh water and salt water swamps, all of which are touched by some roads, it is impossible to specify any single tree that is adapted to all conditions. The rain tree (*Enterolobium saman*) will thrive under more varied conditions than any other species known to the author, but will not stand exposure to salt water, and does not do particularly well on dry hills where volcanic tuff formation is overlaid with thin soil. It thrives, however, under all ordinary conditions, even in the lowland of the average rice paddy country. For exposure to salt water it may be necessary, in some cases, to utilize the trees growing on the borders of the mangrove, such as the pagatpat, api-api, etc., or in some cases even the mangrove trees themselves—that is, provided shade trees are deemed to be essential along roads bordering or running through salt water swamps. For roads bordering the sea, with well-drained soil the palomaria and the duñgon late mentioned above cannot be surpassed; secondary choice for such locations are other strand trees such as the balibago (*Hibiscus tiliaceus*), the baloc-baloc (*Pongamia mitis*), and the botong (*Barringtonia asiatica*).

Main entrance of the Cementerio del Norte, alternating trees (*Enterolorium saman* and *Cassia siamea*).

For dry hills, the rain tree will thrive, but will not do so well in those regions where volcanic tuff is overlaid by thin poor soil. On the whole, this tree will, perhaps, thrive as well as any other in such regions.

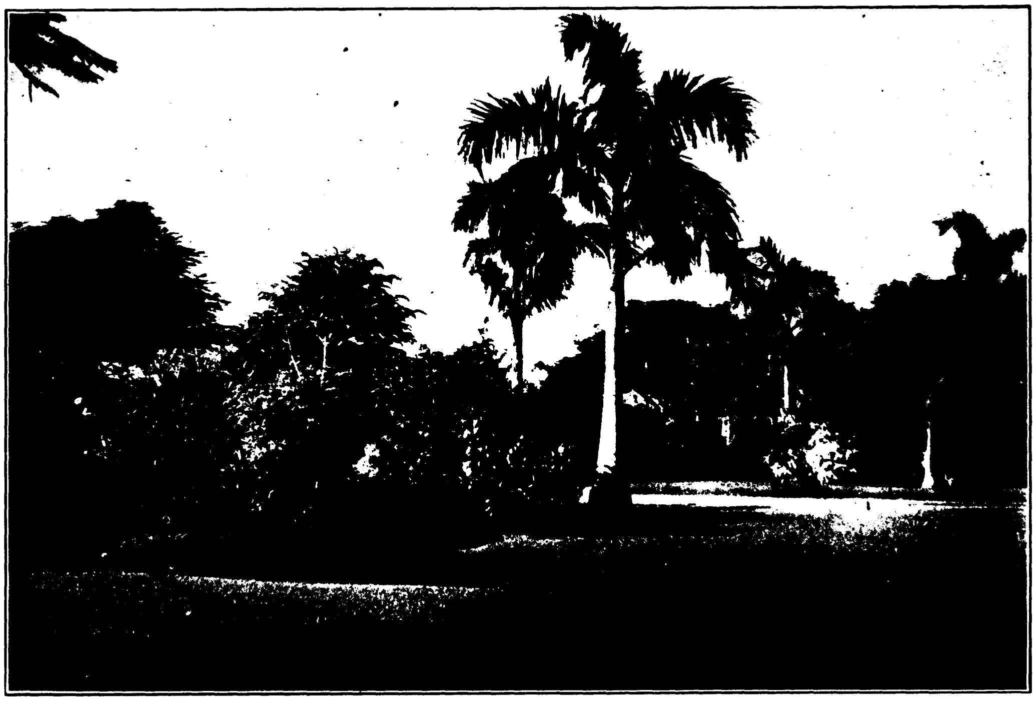
For beautifying parks, grounds about public buildings, etc., a great variety of palms, ornamental trees, and shrubs are available that are not suitable for one reason or another for planting along streets or roads for shade purposes. With the possible exception of the buri palm (*Corypha elata*), none of our palms, either native or introduced, are suitable for planting along country roads, chiefly on account of the insufficient shade produced. In parks, approaches to public buildings, etc., palms may be planted very effectively in avenues. The buri palm is magnificient for avenues, this being our largest and one of the most beautiful of palms; unfortunately, however, its life, said to be about thirty years,

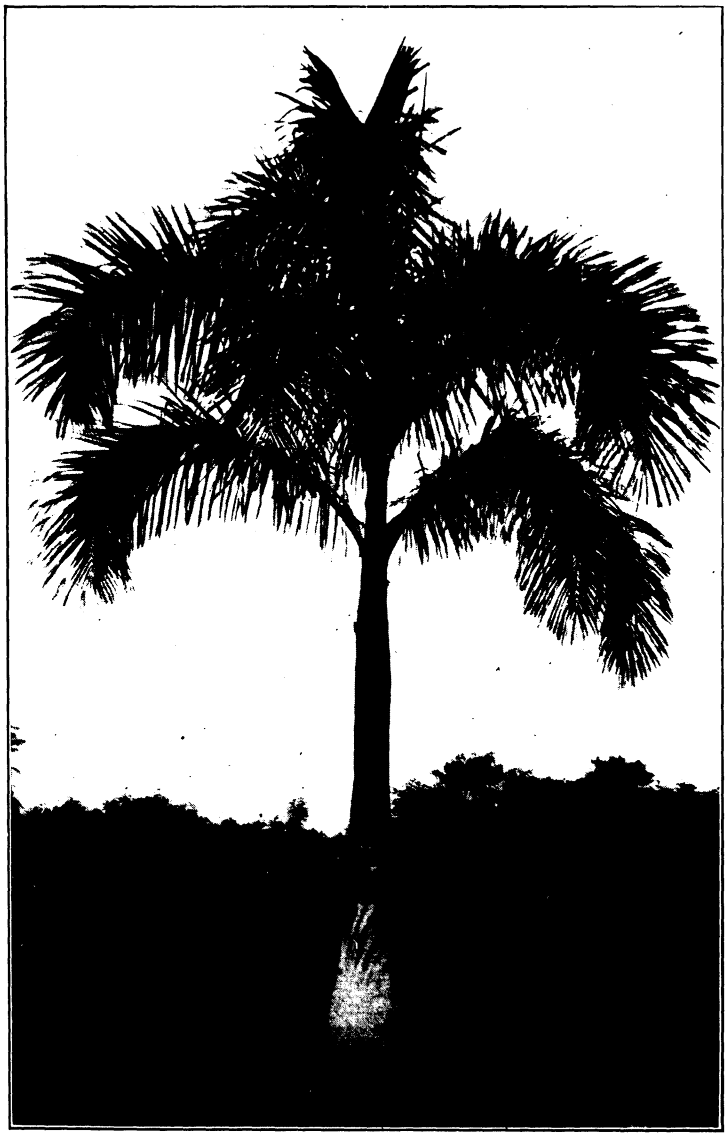
Bridge, main entrance, Cementerio del Norte, Manila, decorated with various shrubs and palms (*Bougainvillea*).

Young traveller's tree (*Ravenala Madagascariensis*).

Tree trunk decorated with Philodendron Radiatum (below) and Scindapsus Aureus (above.)

is rather short. This magnificent palm flowers but once at full maturity, and then dies. The palm best adapted to avenue planting is the royal palm (*Oreodoxa regia*), but the available supply in the Philippines is at present limited to Manila, the palm being of recent introduction here. Coconut palms, while very effective in groups or isolated, are not well adapted to avenue planting as their trunks are rarely strictly erect. The more generally available smaller palms are the betelnut palm (*Areca catechu*), locally known as boñga; the boñga de China (*Normanbya merrillii*); the anahao palms (*Livistona spp.*); the oil palm (*Eleais guineensis*); the sugar palm (*Arenga saccharifera*), locally known as caong or iroc; and the fishtail palm (*Caryota cumingii*), locally known as pugahan. As a rule, the indigenous species are not well adapted to the open conditions found in and about towns, most of them being sylvan species, and many being adapted to special habitats. While, including the climbing palms (rattan, bejuco), about 100 different species of


Lawn with royal palms (*Oreodoxa regia*), shrubs, and trees.


A young palm (*Oreodoxa regia*) about 7 years old.

Young plant of the oil palm (*Elaeis Guineensis*).

palms are found in the Philippines, few are adapted to cultural conditions. In Manila, thanks to the foresight of the municipal authorities, and especially to Mr. J. C. Mehan, at present about 50 different kinds of palms are available, mostly exotics of recent introduction, and are in cultivation at the city nursery at the Cementerio del Norte.

Of ornamental trees, that is, those with showy flowers or variegated leaves, there is really not a large variety to select from. Some (*Peltophorum* and *Cassia*) have been mentioned above under trees suitable for street planting. Among the others the fire tree (*Delonix regia*), a native of Madagascar, and here usually known as cabellero, is by far the most showy and attractive on account of its striking floral display. It should be a feature in every park, and in all of the larger public grounds. It is not adapted to street planting chiefly on account of its deciduous habit, being quite leafless for two or three months in the hot season. The dapdap (*Erythina indica*), showy on account of its brilliant flowers, unfortunately is far from graceful

Young india rubber tree (*Ficus elastica*).

Buri palm (*Coryphaelata*).

Agoho trees (*Cassiarina equisetifolia*) about 8 years old.

in habit, and aside from its red flowers is a very unattractive tree; in the southern Philippines, however, a form occurs with beautiful variegated leaves, well worth extended cultivation. Some specimens, however, may be included in parks to advantage. The camanchile (*Pithecolobium dulce*) and the talisay (*Terminalia catappa*), although common in most Philippine towns, are usually decidedly unattractive, and future plantings for ornamental purposes should be discouraged. The so-called india-rubber tree (*Ficus Elastic*) and the baletes (*Ficus spp.*) in general make very attractive park trees; they are allied to the banyan tree of India. The agoho (*Casuarina equisetifolia*), striking on account of its resemblance in form to the conifers of the temperate regions, is a decidedly ornamental tree, and one of very rapid growth. While it is of wide distribution in the Philippines, it is peculiarly difficult to propagate from seeds, a very sandy soil being necessary. A very showy tree, and one that should always be selected for parks, is the banaba (*Lagerstroemia speciosa*); it is common and very widely distributed in the Philippines. The calachuchi or temple flower (*Plumeria acutifolia*), the ilang-ilang (*Canangium odoratum*), the champaca (Michelia champaca L.), and the caturay (*Sesbania grandiflora*) are too well known to discuss here. Coles maluco (*Pisonia alba*), remarkable on account of its very pale-green or yellowish white leaves, is worthy of more extended cultivation than it at present enjoys, on account of the striking contrast between its pale leaves and the dark-green ones of most other trees. None of the above trees are well adapted to street conditions, and should not be planted for shade purposes along streets or roads.

For park planting a considerable variety of shrubs with variegated or colored leaves is available including the *Graptophyllum* (morado, maluco, balasbas), the closely allied *Odontonema*, the ubiquitous *Codiaeum* (San Francisco), *Panax* spp. (papua), and the recently introduced variegated red and purple leaves *Acalypha wilkesiana*. Fortunately, all of these shrubs with variegated leaves are very easily propagated by cuttings. For shrubs with showy flowers all collections should include the *Allamanda* (Campenelo), with its showy yellow flowers and glossy foliage; several varieties of gomamela (*Hibiscus rosa-sinensis; H. schizopetalus*, etc.); various species of *Bauhinia* with pinkish, white, or yellow flowers; the acheute (*Bixa orellana*); the cabellero (*Caesalpinia pulcherrima*), both the red and yellow flower form; the rosal (*Cardenia florida*); the santans (*Ixora spp.*); *Tecoma stans* with its showy yellow flowers; and the poinsettia or pascuas (*Euphorbia pulcherrima*).

Among the vines at present available, by far the most striking one is the Brazilian *Bougainvillea speciosa*, which should be grown on a tripod or on some other support. In popularity, nothing can rival the Mexican "cadena de amor" (*Antigonon leptopus*). Twiners, useful for screening unattractive walls, are the common local morning glory (*Ipomea cairica*) and the much coarser *Argyreia speciosa*. The former is propagated readily by cuttings; the latter by seeds.

The ornamental effect of well-trained clumps of bamboo is frequently overlooked, chiefly perhaps on account of the great abundance of the bamboos in the Philippines. While they are not adapted to street planting, they can be used to advantage in parks, along lanes, etc. The common spiny bamboo is objectionable on account of the dense thicket of spiny branches about its basal parts, but fortunately a number of spineless bamboos are available in all provinces.

Additional data on this subject may be found in the Philippine Agricultural Review, Volume V, No. 9, September, 1912. A most useful book of reference, and a veritable mine of information on the planting and care of plants in the Tropics is MacMillan's "Handbook of Tropical Gardening and Planting" (Colombo, Ceylon, 1910).

PROGRESS AND HIGHWAY CONSTRUCTION, PHILIPPINE ISLANDS.

By D. E. Henry,
Member Philippine Society of Engineers,
Member American Society of Engineering Contractors.

Road work in the Philippine Islands during the eighteenth and nineteenth centuries, under the Spanish régime, consisted in the opening of routes of communication throughout the Islands, in a very thorough manner, and leaving a very valuable asset to the present Government in the matter of the width of right of way, which was incorporated into the law and became a part of the public domain.

The location of these routes has been justified, inasmuch, that few changes have been made in the general alignment, except when new sections have opened up and a change in location justified. Grades have been improved and method of construction changed. The right of way, as established by law, has made possible the construction methods of to-day. The use of broken stone or gravel on road work seems not to have been practiced by the Spaniard, as little evidence is found to promulgate this belief. Two types of construction under Spanish régime were practiced: First, pavement of cut stone. This was usually of the adobe quality, probably used because it is easily quarried, cut, and handled, the size used called "ordinario" 20 by 20 centimeters and 50 centimeters long. This makes a very smooth and pretty pavement, but, where an ordinary amount of traffic is encountered, wears very rapidly. Had a hard stone been used, the result would have been of a permanent nature. Second, cobblestones. The pavement of cobblestone consisted of boulders probably taken from river beds varying in size from 10 to 30 centimeters in diameter. This type was very durable and lasting, so long as the individual stones retained their position in a bed of earth. Owing to the size used there was no bond, and stones were easily displaced, unless covered with earth, sand, or gravel. This pavement was very rough and, had a second or top course of small gravel been used and bound together with a binding material, would have been in use to-day. Attention is often called to the good roads that existed during the Spanish régime; but from the best information the writer has been able to obtain, these good roads were the result of temporary improvement made for an especial function, and the

Spanish road. Cut adobe stone pavement.

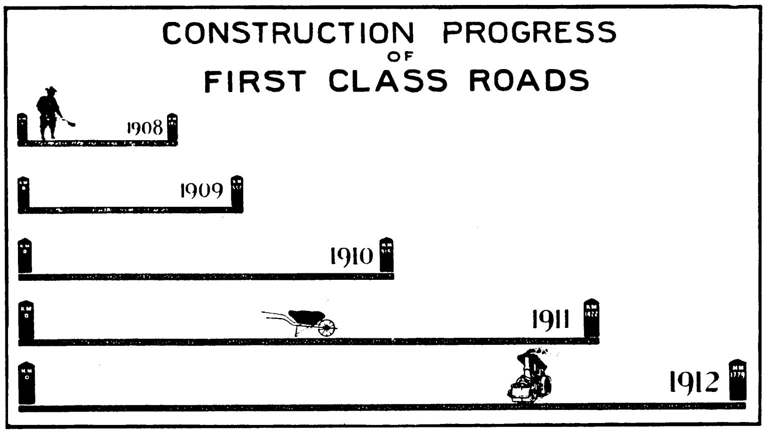
Spanish road, rubble-stone pavement.

informant who imparted the news remembered the road as it was for said special function, and which, in fact, relapsed into its original state in a very short time, and received no attention until some high official desired to make the trip again. As a matter of fact, some roads, owing to the formation or character of the materials, once they were graded, required very little or no work to keep them in good condition.

Owing to the unsettled conditions for a few years prior to 1898 and for a time thereafter, the condition of all roads, except those necessary for military purpose, became deplorable, and, as a result, when the Civil Government took over the affairs, among other things it found a problem in methods of communication of no small proportion. The highway problem has been taken up aggressively and, it is believed, solved to the satisfaction of all concerned.

The Bureau of Public Works was organized in 1905, and there were no first-class roads declared until 1908 when 395 kilometers were brought up to first-class standards.

The following chart gives first-class roads by provinces for 1908 and 1912, showing progress made.



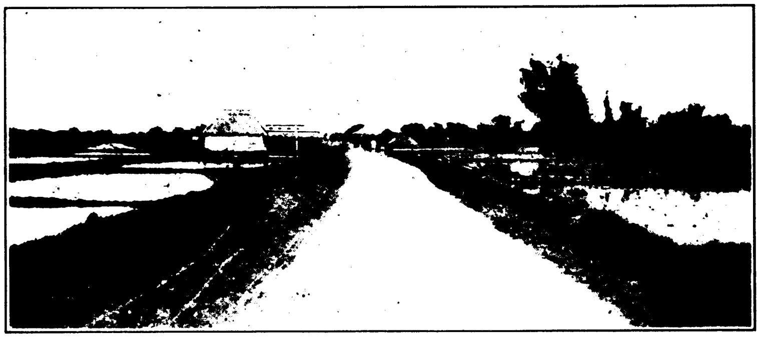
A road system has been worked out and is being rigidly adhered to, being pushed to completion as fast as funds permit. The policy for road work is to maintain those routes of communication already established, and extend others, until every section with justifiable productive traffic is supplied with an outlet for its products. This will consist primarily of the construction of first-class metaled roads; the maintenance of second-class roads, until they can be reached by first-class construction; the maintaining and opening of trails, which may be for cart traffic only or horse trails, and are opened for communication into isolated and mountainous sections. The system comprises through or interprovincial routes and feeder roads.

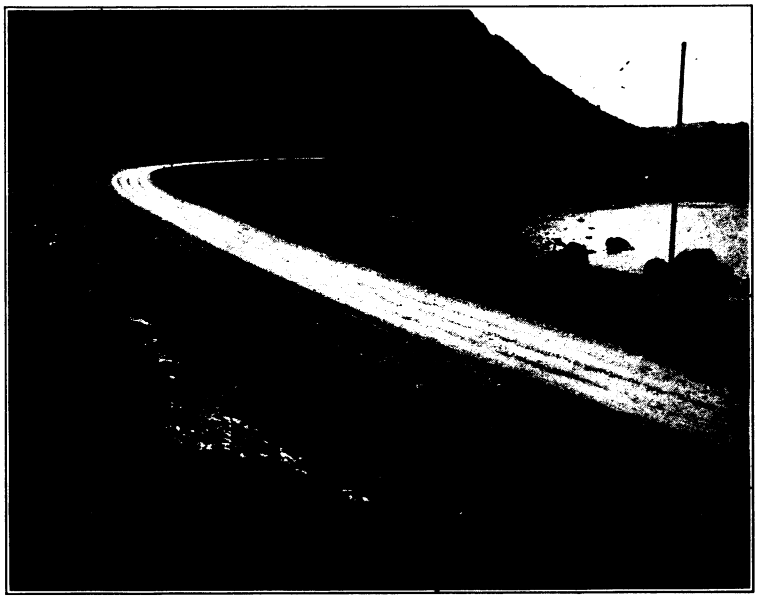
Funds for road work have been provided for in the following manner: Provincial funds accruing from the double cedula of ₱2, ₱1 set aside for road and bridge work; percentage of internal revenue collected, and land tax, aggregating ₱3,000,000 annually in the thirty-one Christian provinces, while certain Acts of the Philippine Commission and Legislature provide Insular aid. It is gratifying to know that Insular aid is on the increase, and within a few years the roads in the Philippines will be an asset, the value of which will be beyond that of any other, and equal to if not the best in the Orient.

The character of the country and soil through which highways in the Philippines are constructed may be classified as follows: Rice paddy; bench or rolling country, as distinguished from river bottom; coastal; and hill or mountain roads.

It has been determined that a heavy crown of three-fourths to 1 inch per foot in the Philippine roads is detrimental, owing to heavy, continued rains, due to the fact that with a heavy crown, the water forms in rivulets, destroying the metaling, while if a flat crown is used the water runs off in a continuous sheet; a crown of one-half inch to 1 foot being found to meet conditions whether asphalted or not.

The grade line through rice paddies is raised slightly above the average tops of the paddy dikes. On bench lands the grade line follows the contour of the ground more closely, as usually the drainage is perfect and no trouble encountered from water standing or running continuously against slopes and keeping subgrade wet. The grade on coastal roads is kept well above high tide and protected from surf, which may do serious damage during storms. Sometimes along coastal routes an arm of the sea, or estuary formed by mouth of a river, is crossed in order to shorten distance. This requires a causeway to be thrown up above high tide. These causeways are subject to the attack of crabs, which honeycomb the embankment, and at times they may be observed as thick as prairie dogs in their native cities. The establishing of grades in hill or mountainous country presents the most difficult problem, owing to unstable character of the formation, which has been disturbed by earthquake shocks, heavy grades necessary, and which are subject more than any other to the destructive effects of heavy rains. The crown on heavy grades is increased considerably. In this connection it may be well to speak of overflow sections, where asphalt is used to hold the metaling intact; while it is absolutely necessary to keep the grade low where overflow sections are left, in order to lessen the liability of washing out, it is also necessary to keep in mind the injurious effect on surfacing where the subgrade is thoroughly saturated for any length of time, and the grade should be sufficiently elevated to insure a dry subgrade under normal conditions, notwithstanding the fact that macadam proved that, with an impervious metaled section, a road could be kept in good condition when subgrade was saturated. This contingency will occur when overflow sections are left in rice paddies.


Road through rice-paddy section.

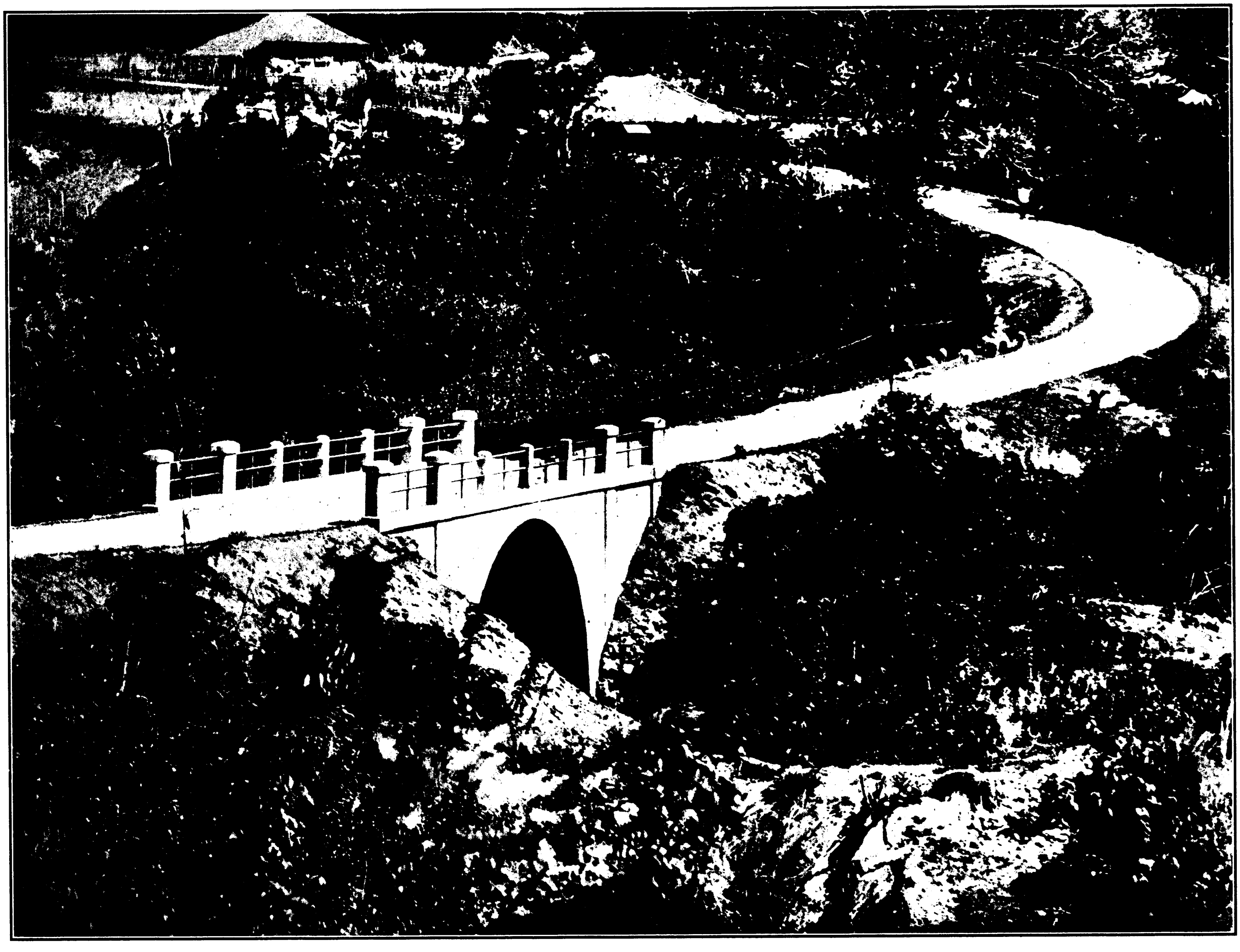

Coast-road section.

Various methods are practiced in building up subgrade in the Philippines. That most generally used being the wheelbarrows to move earth from borrow pit or ditch into roadbed, where one man loosens the material, another loads it into the wheelbarrow, another wheels it into the embankment, and still another levels off the earth after it has been dumped, this method requiring four men who will move not to exceed 3 cubic meters per day; another method is a small basket which is carried on the shoulder by one man; another is a basket "dagadaga" carried by two men swung from a bamboo pole carried on the shoulder; another, where a native bamboo sled is used on which is placed a box for hauling material and hauled by a carabao; and still another, tramway, not generally used.

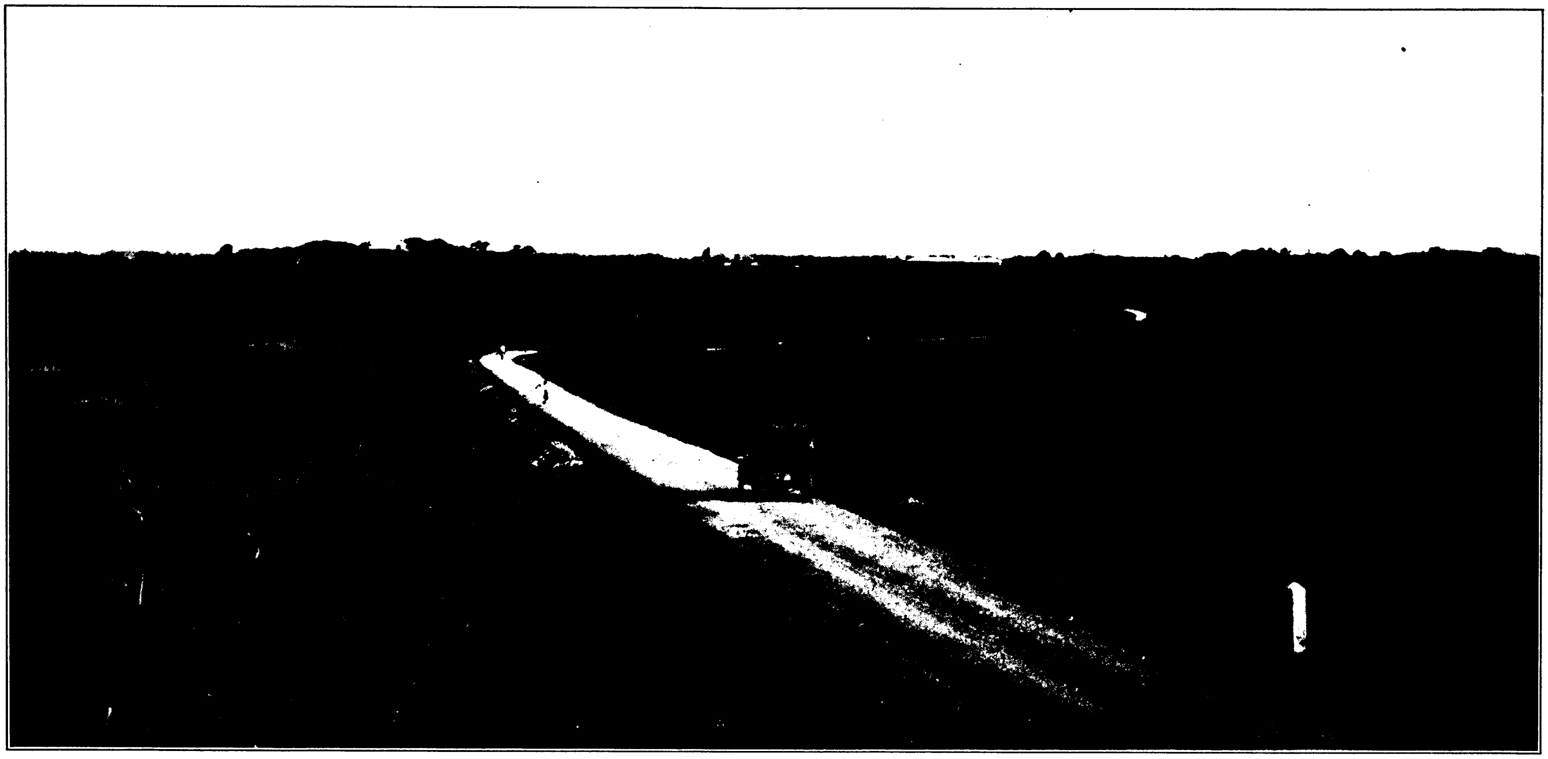
The wheelbarrow method referred to above has been improved on in many instances, where each laborer is given a wheelbarrow, mattock, and shovel, and works independently of any other laborer. In this way each laborer will move from 1 to 1½ cubic meters per day. In all probability, the most effective and economical method, which has been tried out in a number of instances, is by contracting in short section to the natives by the lineal meter, where a number of natives get together, select a capataz who understands the work, and may contract anywhere from 100 to 500 lineal meters. They are furnished all tools and accessories and, where blasting is required, dynamite is furnished. Contracting by the cubic meter has been tried, but it has not given the best of results as compared to contracting by the lineal meter. As a comparison, 1 cubic meter per day is a fair average for the laborer in the Philippines, while 10 cubic meters per day is average per day in the United States on railroad work, where the distance from the borrow pit to embankment is 50 feet or under.

Surfacing materials may be broken stone, gravel, or coral, or combination of any two.

Several methods have been used successfully: First, two courses of broken stone, the first course 12 to 15 centimeters deep, stones varying in diameter from 5 to 10 centimeters; second course 5 to 7 centimeters deep, stones varying in diameter from 2 to 4 centimeters; third course or binder of rock screenings or fine gravel. Second, two courses of gravel placed same as the broken stone except the binder used is clay or a natural mixture of clay and sand; this will be described later on. Third, first course, broken stone; and second course, gravel. Fourth, adobe stone telford 30 centimeters deep, with a top or wearing course of broken stone 3 to 5 centimeters deep of a size used for second course on a macadam road. Adobe stone is found in many parts of the Islands and is easily quarried and handled. Fifth, telford of coral 20 to 30 centimeters deep, with a top course of finger coral. The coral used in telford base is found in deposits along the seashore and can be quarried with a pick. The finger coral used for top course is found along coast line washed out by wave action and, where found, is very plentiful. This type of road costs little to construct, does not necessarily require to compact, as cementing quality is high, presents a very smooth, white surface, and justifies its use where traffic is not too heavy, as it forms a good base upon which to build a more durable surfacing when traffic requires same.


Mountain section first-class road.

The subgrade is thoroughly rolled, all soft spots developing being rerolled until thoroughly compacted. Two methods are in general use for preparing subgrade for stone. The first by trenching the required width of metaling of a depth at the sides for first course.



Rolling-country road.

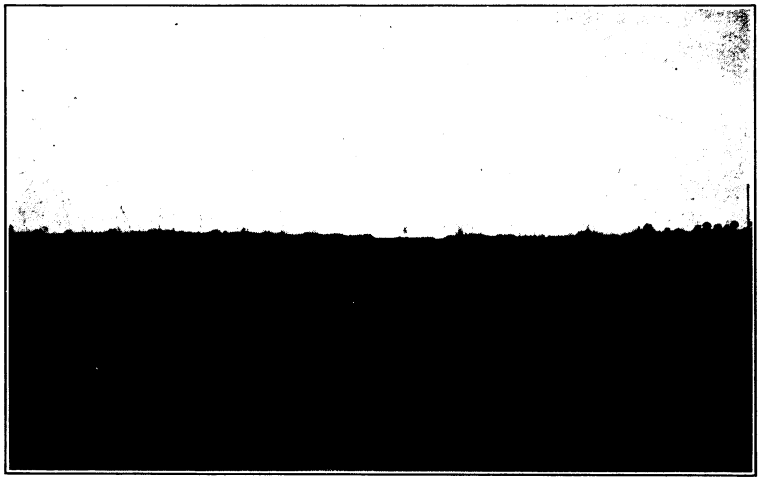
This trench is again thoroughly rolled and has the required crown of finished road. Second, the subgrade is thoroughly rolled and planks 6 inches wide are set parallel with road at a distance from each other equal to the width of metaling to receive first course. Planks are held in place by stakes. After rolling has commenced, the shoulder outside planks can be brought to height, the planks removed, and the surfacing and earth on shoulder thoroughly united.

In the construction of surfaced roads the binder plays an important part. When broken stone is used screenings are used when available, otherwise fine gravel to coarse sand is used. When gravel is used, neither screening nor fine gravel and coarse sand will suffice, unless, of course, a large amount of earth is found in the sand and gravel. Sand will not bind readily with gravel nor make an impervious course of metaling. The best results are to be obtained by using a good quality of dry clay for each course. This is in a finely divided state and thoroughly dry to be sprinkled over gravel in small amount after each passage of the roller until all the voids are filled; when sufficiently rolled, a copious sprinkling of water will be found to be very beneficial. Water must not be added at the time the clay is being driven into the voids, otherwise a sticky surface will result, and it will be impossible to use the roller until dried out. After the last course has been finished a layer of fine gravel, one-half inch thick, is spread over the entire surface to act as a wearing coat until the traffic has finally compacted the road. If a natural mixture of sand and clay can be found so much the better, and probably the best method would be to mix by hand clean sand and clay before throwing on surfacing, but it would be more expensive. Gravel courses require more rolling while being placed than broken stone courses, but it is found that, when finished, the gravel-surfaced road presents a smooth surface under traffic in a much shorter time than broken stone.

River sections over which line of road is located are, in some instances, one or more kilometers in width owing to a narrow coastal plain where the waters rushing down the valleys spread upon coming out on the low coastal plain. This is being taken care of in many instances by locating the road upon higher ground where not prohibited by excessive cost.

Where this is impossible, the river sections are taken care of in the following manner, where a surfaced road would be destroyed by first flood of the rainy season. Cogon grass, tough and fibrous, growing to a height of 10 feet is found in all localities. This is cut

Rolling first course.



Gravel road with filler of volcanic material.

and laid on line of road on top of the sand and in a short time becomes bedded and is easy to negotiate. Sand clay would be a better method, but is more expensive, and one application of the cogon grass lasts the entire season.

It may be well in this connection to describe briefly two other methods which are proving successful and are used only when there is a dearth of surfacing material and the material used is found locally. The first is that of gravel-surfaced roads, using the two courses, and a filler of volcanic earth found usually about 2 feet under the surface soil. The filler or binder is placed in unusually large quantities and especially over the last course, when the surface is maintained by using the same material. An instance of this class of construction is found in one of the northern provinces where 22 kilometers have been constructed with a 3-ton roller. This surfacing wears well under traffic and to all intents justifies this class of construction. The second is that of using sand and clay mixed where the ordinary subgrade is built up and, at least, a cap of 30 centimeters sand and clay placed in alternate layers of 5 centimeters, each layer thoroughly mixed with each other and rolled with a light roller, if available. This method has proven successful in a number of instances and seems to warrant the employment of such a method in places where broken stone or gravel are not available.

Water-bound macadam has been discussed in this paper as this has been the method used during the past six years and in the opinion of the writer will be the class of construction used in the Philippine Islands for years to come, using, however, an artificial binder, such as may prove the best adapted to conditions.

TALAYON RIVER BRIDGE.

By H. A. Raider, C. E., District Engineer of Cebu.

This is a four 7-meter span bridge of the concrete pile bent type which was damaged by the typhoon of October 15, 1912.

This bridge is on the Dumanjug-South road close to Ronda and within 50 meters of the ocean. The concrete piles, 9 meters in length, were driven through fine sand and silt with the aid of two 1-inch jets. During the typhoon the stream scoured out the channel between bents one and three to such a depth that the weight of the floor caused bent No. 2 to settle 10 centimeters and bent No. 3 the amount of 98 centimeters. Plate No. 1 is from a photograph taken two days after the typhoon and before any steps had been taken to repair the bridge. The ends of the two floor slabs, resting on pier No. 3, were within 2 centimeters of slipping off the pile cap.

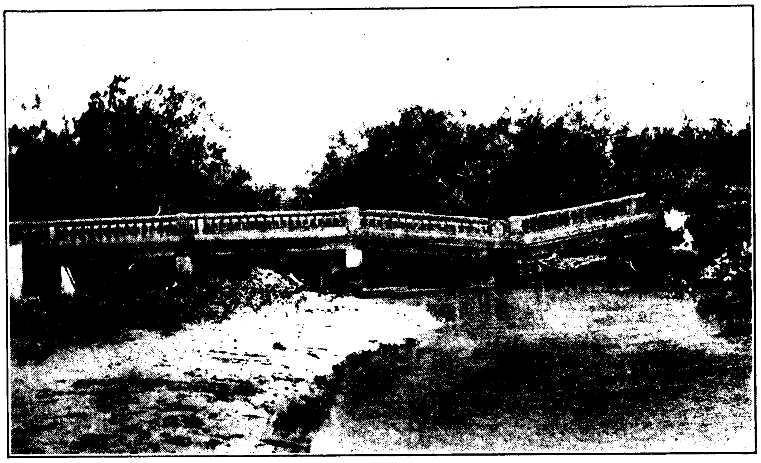


Plate I. Talayon Bridge before reconstruction.

The first steps taken were the securing of large stone and sand and refilling that part of the stream about the two bents that had settled so as to prevent the piles settling any more as it was thought that the sand plus the weight of the large stone would produce sufficient skin friction to prevent any further settling. The large stone was carried up to about the elevation of the bottom of the pile caps, and upon this each side of the pile cap, parallel and close to it, were placed pieces of 45 by 45 centimeters timber. Upon these timbers four 25-ton screw jacks were placed, the slabs raised about 15 centimeters alternately until up to the original floor elevation. The old caps were then built up with concrete and, after forty-eight hours, allowed to carry the floor load. Heavy traction engines have run over this bridge since, causing absolutely no settlement. The bridge as repaired is shown under Plate II.

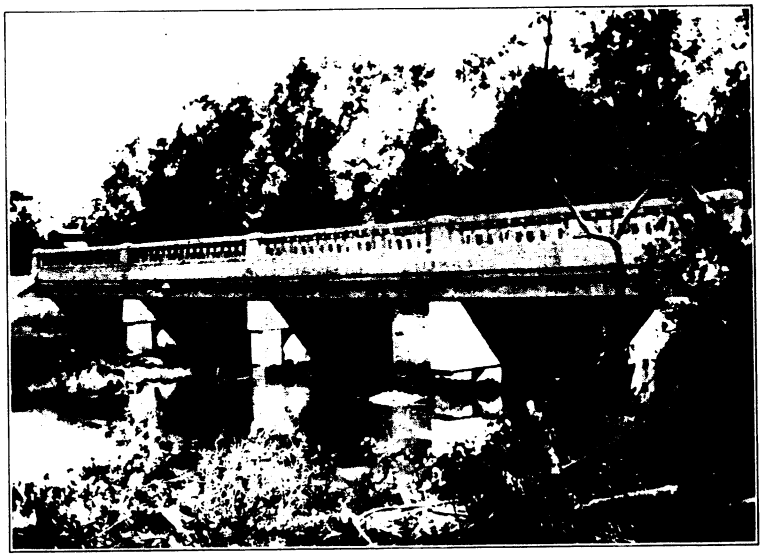


Plate 2. Talayon Bridge as it is to-day, March 17, 1913.

Labor expended on this work consisted of removing the surfacing over the entire bridge, cutting out the balustrade over two sections, transporting and placing stone and sand, raising slabs and rebuilding caps, balustrade, replacing surfacing and about 30 cubic meters of approach fill amounted to ₱406, material used, cost ₱142.

To this should be added ₱100 more for the time of one American foreman who looked after this work in connection with other bridge construction.

WHY IRRIGATE?

By A. H. Sjovall, C. E.

Extensive changes have been made recently in the methods of work of that part of the Bureau which is charged with the legal duty of irrigation construction and matters preliminary thereto. One of these changes was incorporated in a recent special order. This order will in time have the effect of placing under the district engineers all irrigation projects which can be best handled in that way. Generally speaking, the plans are to give to the district engineer, who has the necessary experience, charge of the construction of these irrigation projects in his district which are less than 3,000 to 5,000 hectares in area, although this limit may be exceeded. The order does away with all idea of attempting to cover this entire territory of the districts with a separate force of engineers to construct irrigation works only. In addition to this change in organization the method of selecting and approving irrigation projects has been extensively altered.

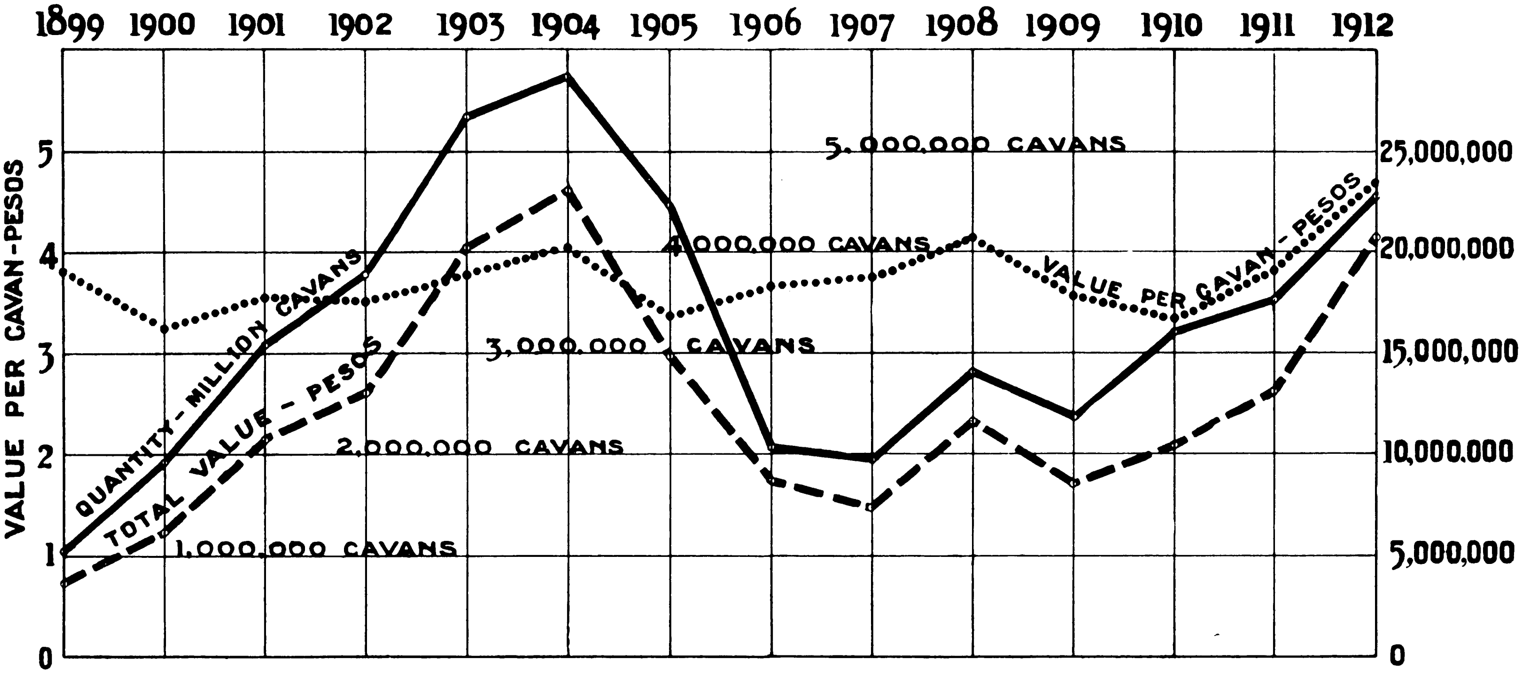
The result is a distinctly more economical and practical procedure. The irrigation work is now as completely an integral part of the Bureau as any other work. The outlook for actual results is bright and these results will be secured with a smaller outlay for preliminary work than heretofore. Just at this time, therefore, an outline of the present situation, and of the objective sought, should prove interesting. These notes, while based on a report made to the Governor-General some time ago, contain much that has become available only within the past few months.

Several provinces, Bulacan, Cavite, and others, now have small areas irrigated by dams, headgates, and ditches, which were constructed in Spanish times. These areas are largely on haciendas which before belonged to the friars. This systematic irrigation, supplying water continuously to cultivated land, does not cover much, if any, more than 50,000 hectares in the aggregate. Fifty thousand hectares is equal to an area about 14 miles square; only the area covered by one good sized Texas ranch.

Some of these works are 150 years old or more. In laying out and operating them a high degree of skill was employed. There are long tunnels for carrying water under ground and inverted siphons for carrying it under rivers. There are canals of fair size. With all the restrictions which existed as to material some of the works have proved very durable when properly maintained. Usually the provision made for handling flood waters has proved sufficient.

In addition to these works for systematic irrigation, there are many places where primitive methods are employed. Such methods usually consist in damming a small stream with brush and stones, or with bamboo and similar materials, thus raising the water level a few feet. The spot selected for such work must be usually somewhat above the field to be irrigated, and so we find most of these works on rapid streams in the hills.

When the level of the water is once raised sufficiently to turn the water into the ditch a supply continues as long as the dam exists and there is neither too much nor too little water. Too much water, in fact the first high water, sweeps away the dam. The usual location on a rapid stream makes the dam especially likely to be subjected to torrents. Too little water means only enough to supply the underground current in the stream bed and the usual leaks in the dam. There may be sufficient water to irrigate the desired area, but this kind of a dam will not secure it unless there is much more than sufficient. These primitive works, whether of the kind just described, or whether depending upon treadmill, manual labor, or similar methods, are either undependable or adapted only to single small farms. The total area thus irrigated is small and uncertain.



IMPORTATIONS OF RICE, BY FISCAL YEARS.

The reports for the fiscal year ending June 30, 1911, which are the last available, give the area planted to rice in the Philippine Islands as a round million hectares. As we have seen there is only some 5 per cent of this area which is really irrigated. This million hectares produced a crop which yielded about 10,000,000 cavans of cleaned rice. This was not a bumper crop, neither was it an especially poor one.

We now come to the question of how much rice is necessary. There is no getting away from the fact that rice is the principle food of the Filipino. Also, quite aside from any economic question involved in continuously sending a large amount of money out of the Islands for the purchase of a staple which can be produced here, it cannot be doubted that to get rice to the people at the least cost it must be produced here. Rice we must have. Then how much of it?

The last census was taken ten years ago. Figures available on the population of the Islands are therefore estimates. The estimates are practically all between 8,000,000 and 9,000,000. Of this number there are perhaps 4,000,000 who would consume a full ration of rice if they could secure it. There are probably another 2,000,000 who require somewhat less. A Filipino laborer subsisting mainly on rice requires about two-thirds of a kilogram daily. Call it 4½ cavans yearly. (NOTE.—In this article cavans are taken as equal to 57.5 kilograms.)

We see from these figures that we are safe in saying that the Islands to-day should have, to meet domestic demand, a supply of not less than 20,000,000 cavans and probably not more than 24,000,000 cavans yearly.

We have seen that the crop is usually about 10,000,000 cavans. The only other large source of supply is from importation. The chart below shows, for each year since 1899, the quantity which was imported, also the value at customs and the average value per cavan for the imports.

Practically no rice is exported. The total rice exports for the last two years have been 27 and 5,948. kilograms, respectively. We may assume for all practical purposes that the imports are solely cleaned rice. We may incidentally note in passing that during the period in question the low point in average value of imports is uniformly about ₱3.25 per cavan and that usually the more we import the more we pay per cavan for it.

It is also to be noted that the amount of rice imported in 1912 showed a great gain—actually 28 per cent—over the imports of the previous year. This was due to a drought which made it impossible to harvest any crop whatever on considerable areas which had been planted. Exact figures are not yet at hand, but it is very probable that the total yield fell from the 10,000,000 cavans of 1911 to less than 7,000,000 cavans.

Along with the increase of 28 per cent in amount imported came as usual an increase in average value per cavan imported. This average reached ₱4.67 per cavan, the highest value during American administration. This exceptionally high figure was largely due to the fact that the Philippine shortage was coincident with a shortage in the surrounding countries. It is further to be noted that while the local production of this principal article of food fell 3,000,000 cavans, the importations made this good to the extent of less than 1,000,000 cavans. Since there is no great amount of rice in storage, this last showing is conclusive on the futility of depending even partly upon importation.

The average importation for the period shown is about 3,300,000 cavans annually. The question as to what the average normal rice importation really amounts to is one which admits of a great deal of discussion. It suffices for our purpose to note that it is in any event below 4,000,000 cavans yearly.

We have then a normal demand for rice of at least 20,000,000 cavans. We have crops which run about 10,000,000 cavans in a normal year and importation which averages less than 4,000,000 cavans. The staple food is 6,000,000 cavans short. This deficiency is made up largely by a considerable fraction of the population turning to other products such as corn. In fact, the price of rice in certain localities is normally at such a figure that the population generally must turn to another food. This is the case in Cagayan Province. The balance of the deficiency is undoubtedly made up by short rations.

We have then a round millon hectares planted to rice, but notwithstanding this, one-third of the rice used is imported and one-third of the rice-eating population is either on short rations or doing without rice. What is the remedy? We know that unirrigated land will give one crop a year, but that this crop will vary with the rainfall. In seasons of drought we have a poor crop. We know that irrigated land will give not merely one crop a year but that it will give two. We know that it will do this without any especial increase in the number of farm animals, farm equipment, or farm hands needed.

Again we can see that if 1,000,000 hectares is planted to rice and from that we get 10,000,000 cavans of cleaned rice that the average yield is 10 cavans per hectare per year. Making every allowance for crops which did not mature it is evident that the average yield of the rice-producing land is very low. A fair crop should run double the amount named and well-irrigated land, properly cared for, may be depended upon for 30 to 45 cavans per hectare per rainy season crop. The question at once arises, in considering possible increase in local rice production, is, therefore, what land is there susceptible of irrigation?

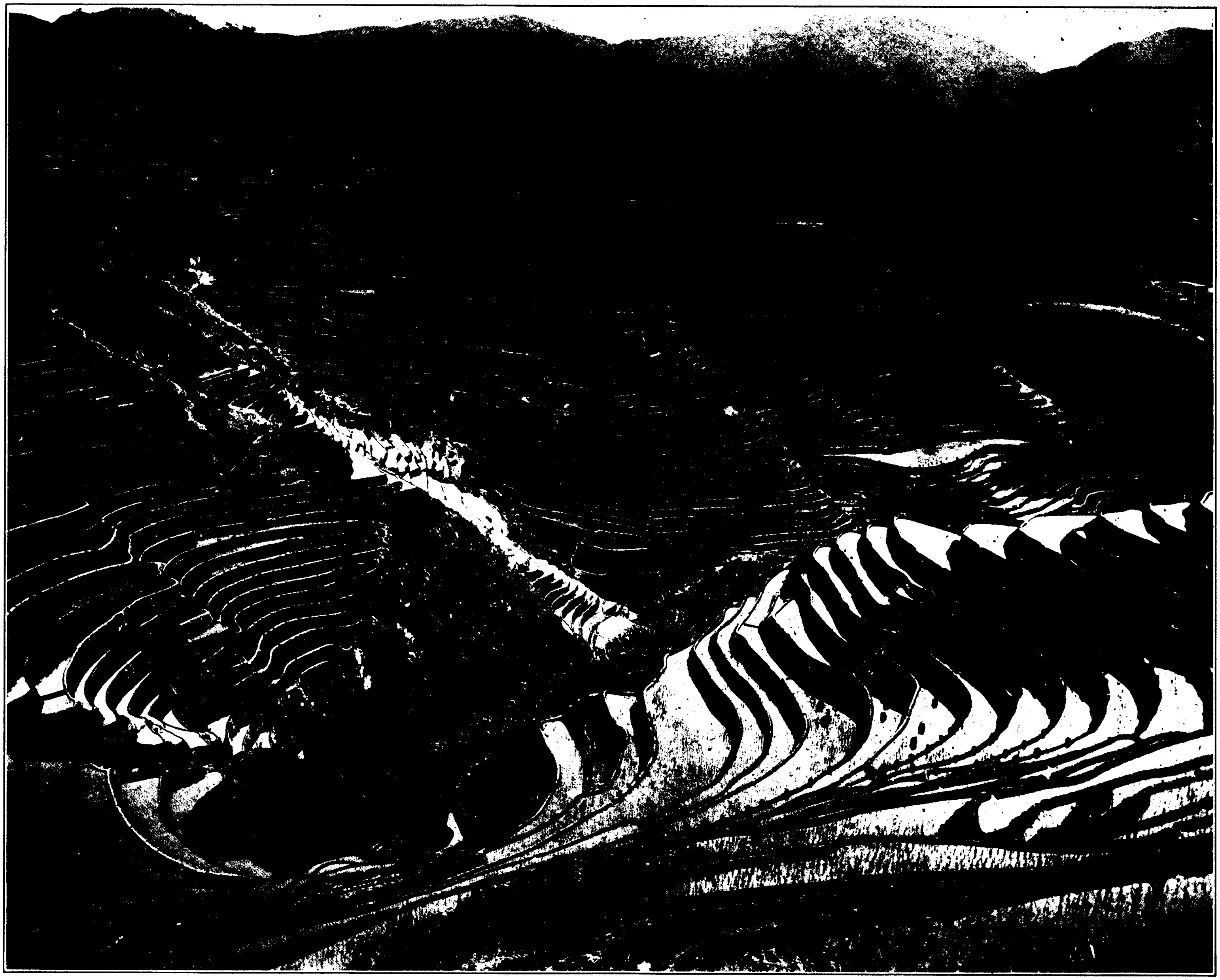
Rice paddies in the lowlands of Luzon.

Before considering this we may note that in addition to increasing the yield and in addition to ensuring against drought, irrigation will ordinarily permit two crops to be harvested. But in order to be conservative, because of plant disease, because not every one will plant two crops, we will ignore altogether in this article the yield of the second crop. We may mention, however, the fact that if rice is ever produced for export it will be because of the planting of a second or dry-season crop. The wet and dry season crops together should be expected to run 50 cavans per hectare each year.

In this matter of area of land available and susceptible of irrigation a preliminary investigation has been made by the Bureau. Of the 1,000,000 hectares planted to rice probably 500,000 hectares is irrigable at a cost which would make the undertaking a success. One-half of this total area planted to rice, or 500,000 hectares, lies in the central valley of Luzon and now produces over 40 per cent of the Philippine rice.

If the 500,000 hectares, or one-half of the present total area planted to rice, were all irrigated we should secure therefrom at least 16,000,000 to 18,000,000 cavans yearly. With this yield, and assuming that the remaining one-half produced its present yield of 5,000,000 cavans, we would have sufficient for our present needs. It would then be time to talk of exporting rice. When we reach that point our people will be better fed at a lower price. That is the main thing. As to possibilities, it suffices to note the island of Java. It has no advantages over the Philippines in the matters of climate and soil. Its area is only one-half the area of these Islands. Its population is three times ours. Yet it raises all its own rice and also goes into the rice export business. The reason is not far to seek. The area of the systematically irrigated land in Java is twenty-six times the area of the systematically irrigated land in these Islands.

Yes, you will say, especially if you are an American with the ever-present idea of getting to your objective and getting there quick, Why don't we go ahead; what do we need? The needs of work of this kind are first, engineers; second, time; and third, money. The engineers we have. The time factor enters on several counts. We need time to gage the stream and find out how much water there is, whether there is sufficient now and whether there will be sufficient in the dry spells. We have to wait for a low-water period and this comes only with an extreme dry spell. Also we should know the high water levels. These things cannot be taken on hearsay or the testimony of old inhabitants. We have to wait for several years and patiently measure the water, for it is evident that too great an allowance for high water is very expensive in concrete and other materials of construction, so much so that a successful financial issue might be prevented. Similarly, if there is too little water in dry spells continuous irrigation may be impossible. This measuring of streams together with the related matters of measuring rainfall



Courtesy of Bureau of Science.

Rice paddies in the mountains of Luzon.

and ascertaining the duty of water has been actively carried on for five years. At a number of places to-day we can tell closely how far these conditions vary from those in the United States. So far as this matter of collecting engineering data is concerned we can begin actual construction work at several points. At those points we know what we need to know to make work a success.

There are other time factors. The old practices in the matter of securing property owners' consent, in charging for use of water, and in reimbursement were incompatible with the new order of things. A law had to be worked out and passed. This was done at the last session of the Legislature. The time factor here has at last become only a question of routine and of pulling together.

We come to the last requirement—money. The irrigation of the 500,000 hectares will require probably not less than ₱100,000,000. A large sum you will say, more than we can hope to get. Please note right here that we don't have to get this sum all at once. Even if we could it would take at least a decade to spend it properly. Also compare it with the amount paid for rice to the inhabitants of other countries within the past fourteen years, namely, ₱175,000,000. At this rate the amount we actually pay out for imported rice every eight years is equal to the entire sum we need in order to complete irrigation works to give us our own rice. The amount of money available for irrigation work has so far kept pace with the demands upon it. To-day the appropriation runs to ₱750,000 a year.

All things considered, the calendar years 1913 and 1914 should witness an impetus to irrigation work such as has already come to road, bridge, artesian well, and building work.

These notes have not touched upon the question of the irrigation of other crops than rice, although great developments are possible there. Nor have we touched upon the related question of area now usually planted to other crops than rice. It is to be noted that the present condition in the rice fields point to a bumper crop, perhaps even one which will reduce the ₱21,000,000 of rice imports in 1912 to half that figure for 1913.

TEST ON FOUNDATIONS IN THE MANILA PORT DISTRICT.

JOHN W. GRAHAM, C. E.,
Associate Member American Society of Civil Engineers.

The section of Manila known as the "port district," is almost entirely reclaimed land. It was made by pumping material from the bottom of Manila Bay and depositing it back of a rock sea wall by a hydraulic dredge and pipe line. The depth of this fill is, in general, between 20 and 30 feet. The work was completed in 1905.

The bottom of Manila Bay near the mouth of the Pasig River, to a depth of at least 100 feet, is covered by a deposit of very finely divided silt, including considerable sewage and similar waste products, mixed with fine coral and sand.

As the port area fill was made by the hydraulic process, the different classes of material were deposited in different locations, the coral and sand in belts near the pipe line, and the silt and finer materials at greater distances. These beds of sand and coral are compact and have fair bearing power. They are limited in extent, however. The silt, or mud, which comprises the greater part of the district is free from voids and saturated with water. It is practically incompressible and acts as an imperfect fluid. Vibrations caused by a truck passing over one of the roads can be easily felt 100 feet distant. Its bearing power is negligible.

Most of the buildings which will be constructed in this district will be bodegas, with office room as a secondary feature. These buildings will have the main storage room on the ground floor, with offices and light storage on the second floor. This type of construction will concentrate only moderate loads on the pier foundations, but the ground floor loads will be comparatively heavy, probably ranging from 1,000 to 2,500 pounds per square foot.

A number of tests of the bearing power of the soil, and experiments to determine the most economical method of increasing this bearing power, have been made by the Bureau of Public Works in connection with the construction of the two bodegas for the Bureau of Supply.

One of the first of these tests was made on a section of the road at a point near the east end of the present buildings. The discharge of one of the pipe lines was located near this point, so that the fill here is composed almost entirely of shell. The road cross-section at this point was made up as follows: Material in fill, 5 inches of shell, 5 inches earth and sand, 4 inches refuse talim stone of 3 to 4 inch sizes, 9 inches broken talim stone of one-half to 2½-inch sizes. The original surface settled about 10 inches under the roller.

Six pieces of 8 by 12 inch by 5 feet timber were laid side by side on the ground and on top of these a platform was erected. The load was placed on this platform in 5-ton increments and readings were taken between each increment. A total load of 100,882 pounds was placed upon the platform. Under this load the road failed completely, the timbers settling till the platform rested on the ground. The failure was practically local, extending only a few inches beyond the edge of the timbers. Detailed information will be found in Plate I.

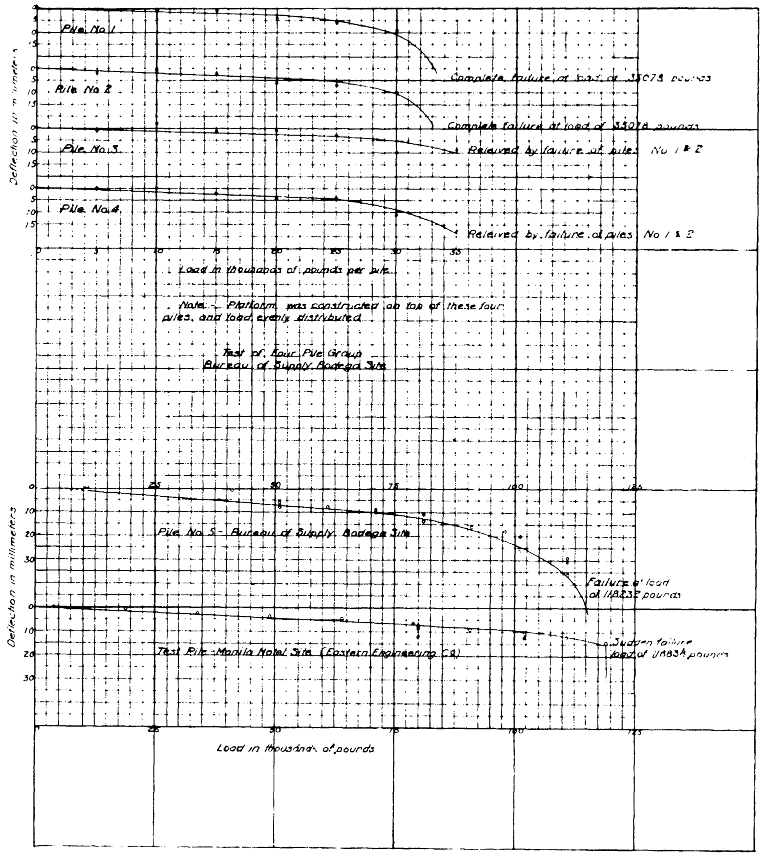


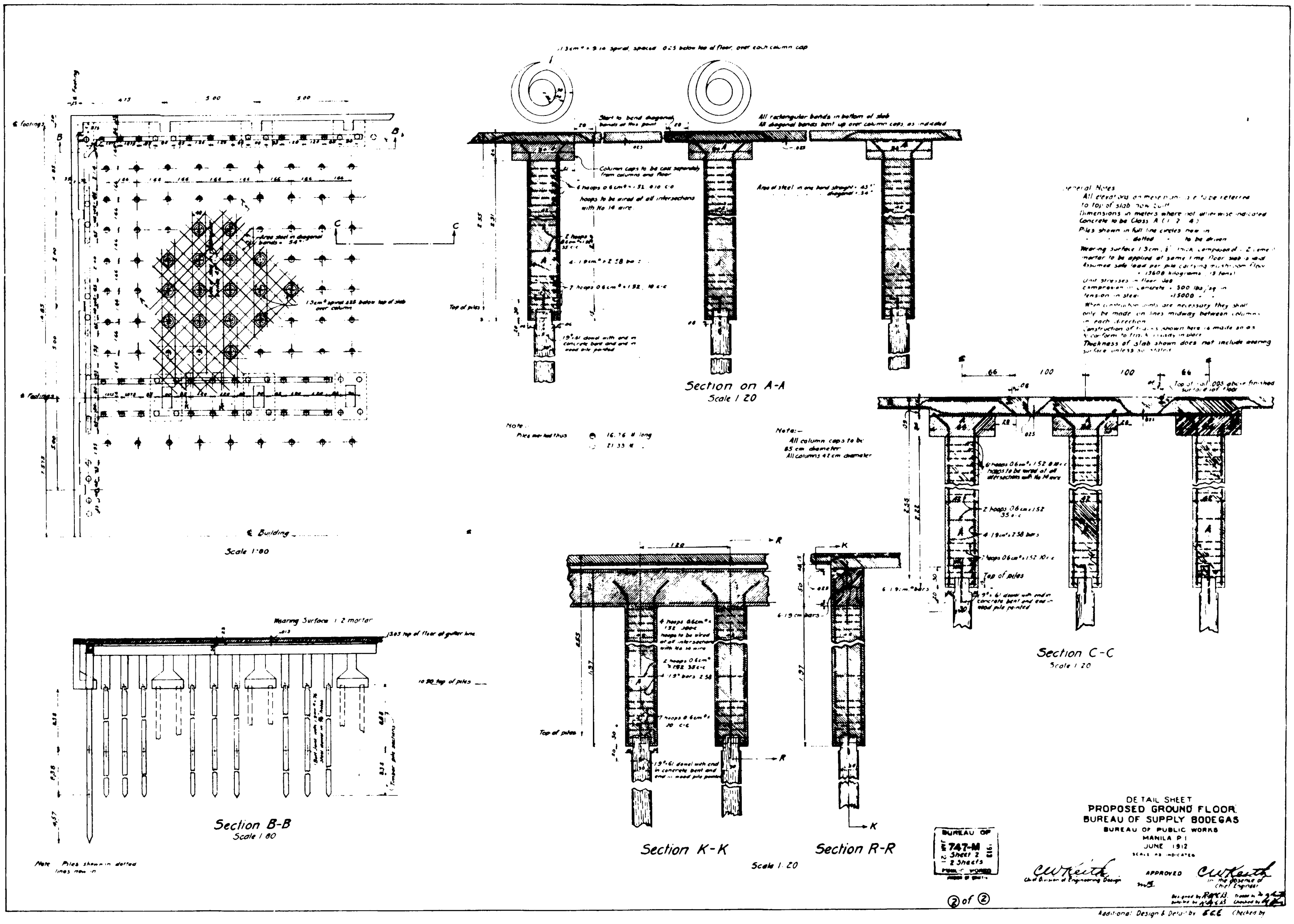
Plate I. Bearing power of piles. Deflection curves.

In addition to the above-described test of the bearing power of the road, several tests of the supporting power of piles were made. In the first of these tests a cluster of four piles, driven into the mud near the west end of the present south bodega, was capped and provided with a platform carrying the load. Complete records of this test are given in Tables II and III and Plate I. It should be noted that these piles derived their supporting power almost entirely from skin friction, the bearing power of the soil being practically nil. The final load was placed on the platform by 5 p. m., May 16. Failure occurred suddenly, about 7 p. m. the same day.

For the second test, record of which will be found in Tables II and IV and Plate I, a single pile, which had been driven near the east end of the present south bodega in October, 1909, was capped and provided with a platform. It will be noted that this pile had been in place about eight months at the time of the test. It should also be noted that this pile was driven through sand and shell.

The record of a pile tested for the Eastern Engineering Company, at the Manila Hotel site, is given in Table V and Plate I. Information as to the character of the soil through which it was driven is not available.

The road test seemed to indicate that sufficient bearing power could be secured by rolling or tamping a gravel fill into the mud. Accordingly, a concrete floor was built in the south bay of the Bureau of Supply south bodega in the following manner: The mud was excavated to 50 centimeters below the finished floor elevation; a layer of Pampanga sawali was placed at the bottom of this excavation; on the sawali gravel was tamped and levelled to a plane 15 centimeters below the finished surface; a 15-centimeter concrete slab, in sections 2.5 meters square, was built on the gravel; no reinforcement was used.



A timber bin, approximately 16 feet square, was built in the center of the third panel from the west end of the building and filled with sand weighing 98.75 pound per cubic foot. Under a load of 395 pounds per square foot the floor settled from 2 to 6 centimeters at different points. Complete failure was caused by a load of 900 pounds per square foot.

A section of the same floor, over the shell at the east end of the building, was loaded in a similar manner to 1,000 pounds per square foot and showed a total settlement of 6 millimeters. The load remained in place for nine days.

These failures having destroyed faith in the gravel-fill plan, various methods of pile construction have been considered. Sand piles, although cheap, are too liable to displacement to be considered in a region subject to earthquake action. Concrete piles are expensive and would add considerably to the dead weight to be carried by the soil. Their strong point, permanency, is also possessed by timber piles driven below the permanent saturation point. Timber piles also are comparatively cheap and easy to handle.

A design for a concrete floor, supported on timber piles, to carry a load of 1,000 pounds per square foot was prepared by the division of engineering design. It is shown in Plate II. Two panels of floor, in accordance with this design, were finished in the Bureau of Supply south bodega about the middle of September, 1912. A section 16 feet square, near the center of this slab, was tested between September 30 and October 3, 1912.

A timber bin was built of 2 by 12 inches by 16 feet horizontal planks, with 4 by 4 inches exterior braces thoroughly wired together. The bin was filled to a height of 9 feet with sand weighing 104.38 pounds per cubic foot. Under this load the maximum settlement at any point was 8 millimeters. The cracks shown on Plate III, as no load cracks, were caused by this test.

A second test of the same floor was begun January 21, 1913. A bin similar to that above described was located as shown on Plate III. Sand was loaded at the rate of 100 pounds per square foot every day except Sundays, until a total of 2,000 pounds per square foot of the loaded area had been reached. This load was allowed to remain for nine days until all settlement had ceased.

Readings were taken four times daily until the final load had been placed, and thereafter one daily at the points indicated on Plate III to determine the floor deflection. Readings to determine the lateral movement of the walls, were taken at the same time. The results of the observations on the floor have been plotted in Plate IV. The observations for lateral deflection were entirely negative.

A comparison of the curves of Plate IV with those of Plate I would indicate that the load applied was approaching very closely to the load which would cause failure. Possibly 2,500 pounds per square foot is a fair assumption for this load, which would make a factor of safety for the floor of 2.5.

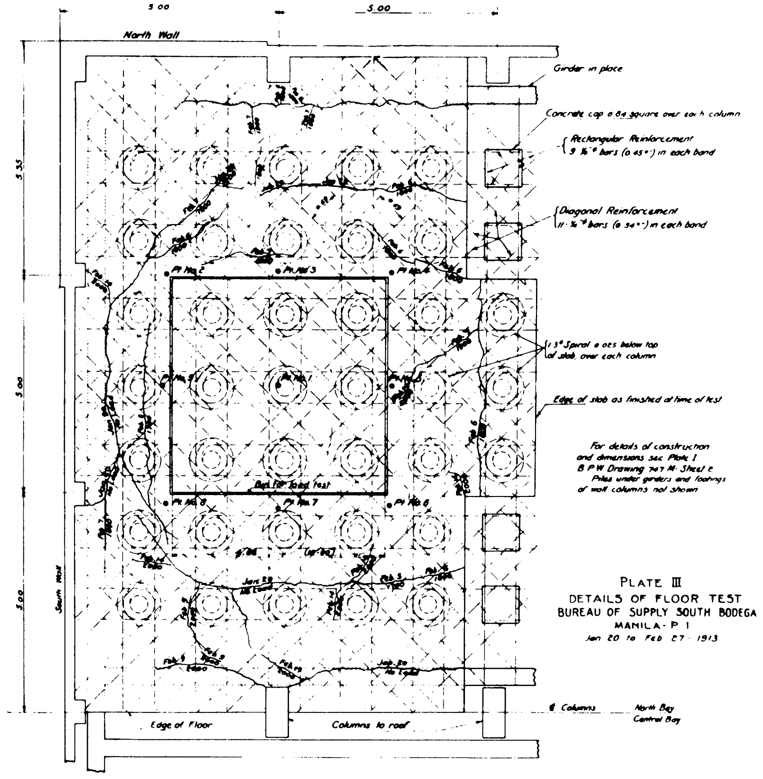

5.00
5.00
North Wall
South Wall
Girder in place
Concrete cap 0.84 square over each column
Rectangular Reinforcement 9 ¾" bars (0.45) in each band
Diagonal Reinforcement 11 ¾" bars (0.34) in each band
1 3" Spiral 0.05 below top of slab, over each column
Edge of slab as finished at time of test
For details of construction and dimensions see Plate I. B P W Drawing 747 M. Sheet 2. Piles under girders and footings of wall columns not shown
Edge of Floor
Columns to roof
℄ Columns
North Bay
Central Bay

PLATE III
DETAILS OF FLOOR TEST
BUREAU OF SUPPLY SOUTH BODEGA
MANILA - P I
Jan 20 to Feb 27 1913

The concrete floor made a remarkably good showing under very severe conditions. It was first tested to the load for which it was designed when less than a month old. Then after six months it carried twice the designed load, with supports yielding nonuniformly, and only showed one small crack inside the loaded area.

The writer believes that the above tests have demonstrated that this type of floor can be built to carry any reasonable load required. It is not a cheap method of construction, but the advantage of having bodegas located near the water front will more than offset the extra cost of construction in this district.

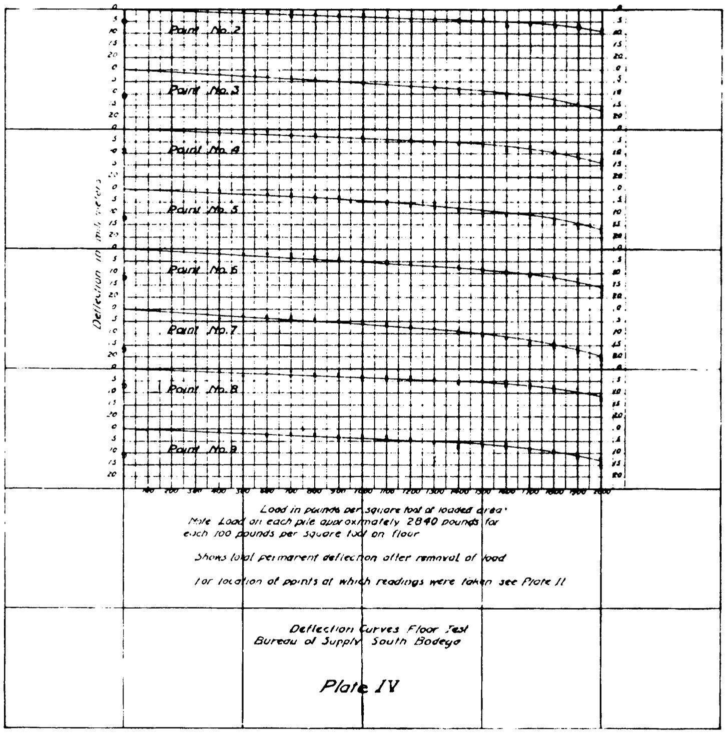


Plate IV

TABLE I.—*Test of bearing power of road.*

Load.		Deflection at corner.				Remarks.
Total tons.	Pounds per square foot.	1.	2.	3.	4.	
5	500					Initial reading.
10	1000	0.002	0.003	0.008	0.008	Tipped because of uneven load.
15	1500	.001	.003	.010	.008	
20	2000	.006	.007	.014	.015	
25	2500	.007	.009	.022	.022	Depression shows around edge of platform.
30	3000	.017	.019	.026	.027	
35	3500	.016	.018	.040	.042	
40	4000	.029	.026	.045	.052	
45	4500	.040	.034	.064	.076	Perceptible depression at point No. 1.
50	5000	.071	.072	.104	.116	

At 45 tons cracks for entire length of timbers about 1 inch distant, between points 3 and 4. Corners 1 and 4 breaking first.

At 95,132 pounds there are two complete circular cracks, one about 1 meter from base of platform, the other about 1.5 meters.

At 100,882 pounds ground settled until platform rested on ground twenty minutes after loading was stopped.

TABLE II.—*Driving record of piles tested, Bureau of Supply bodega site.*

Pile No.	Date driven.	Length.		Diameter.		Settlement due to own weight.	Settlement weight of hammer.	Blows.	Free fall of hammer.	Average penetration last 6 blows struck.	Kind of hammer.	Weight.	2 W H S 1
		Below ground.	Above ground.	Tip.	Butt.								
		Meters.	*Meters.*	*Cms.*	*Cms.*	*Ft. in.*	*Ft. in.*		*Feet.*	*Inches.*		*Pounds.*	
1	Apr. 10, 1910	13.6	0.35	22	34	10 0	34 6	12	2	4	Steam	3,000	2,400
2	do	13.5	.35	20	32	11 4	34 6	18	2	6	do	3,000	1,710
3	do	13.5	.35	25	33	10 5	33 8	20	2	5	do	3,000	2,000
4	do	13.6	.35	22	31	14 2	34 4	14	2	4	do	3,000	2,400
5	Oct. 1, 1909	18.5	1.50		25	8 0		45	10	5½	Drop	2,600	8,000

Table III.—*Test of cluster of four piles.*

Date.	Load.		Deflection of pile.				Remarks.
	Total.	Per pile.	1.	2.	3.	4.	
1910.	*Pounds.*	*Pounds.*					
May 10							Initial reading.
May 12	20,286	5,072		0.002	0.001		
May 12	40,133	10,034	0.001	.001	.002		
May 13	60,330	15,083	.001	.002	.001	.002	
May 14	80,209	20,052	.004	.006	.001	.004	
May 15	100,287	25,072	.006	.007	.003	.004	
May 16	120,262	30,066	.009	.010	.010	.011	
May 17	140,310	35,078	.364	.353	.009	.018	

Table IV.—*Load test on pile No. 5, Bureau of Supply bodega site.*

Date.	Time.	Load.	Settlement.	Remarks.
1910.		*Pounds.*	*Meters.*	
June 1	Afternoon	10,722		
June 2	do	40,760		
June 3	Forenoon	40,760	0.001	
Do	2.40 p. m	50,762		
June 4	8.30 a. m	50,762	.006	One side of platform tipped, bending rod upon which readings were taken.
Do	1.45 p. m	50,762	.008	
Do	2.20 p. m	60,834		
June 5	7.20 a. m	60,834	.008	
Do	8.30 a. m	70,986		
June 6	8 a. m	70,986	.009	
Do	1.55 p. m	70,986	.010	
Do	3.10 p. m	81,216	.011	
June 7	3.15 p. m	81,216	.014	
Do	4.05 p. m	90,975	.016	Pile sinking into 12 by 12 inch timber cap.
June 8	2.55 p. m	98,153	.018	
Do	3.20 p. m	101,026	.020	
June 9	2.10 p. m	101,086	.026	
Do	3.45 p. m	111,036	.029	
Do	3.45 p. m	111,036	.031	
June 10	1.50 p. m	111,036	.036	
Do	3.30 p. m	118,232	.120	Loading stopped as 12 by 12 inch was cracking.

Table V.—*Test pile, Manila Hotel site, Eastern Engineering Company.*

Date.	Load.	Settlement.
1910.	*Pounds.*	*Meters.*
March 1	4,110	
March 2	34,030	0.0007
March 3	34,030	.0027
March 4	48,990	.0037
March 5	63,950	.0047
March 7	78,910	.0064
March 8	80,780	.0089
March 9	80,784	.0122
March 10	80,786	.0074
March 11	80,786	.0074
March 12	90,786	.0088
March 14	102,786	.0109
March 15	102,786	.0129
March 17	102,786	.0125
March 18	110,786	.0122
March 19	118,786	.0144
March 21	118,838	.0802
March 22	118,838	.0808

THE HOUSE BY THE SIDE OF THE ROAD.

By Sam Walter Foss, Highway Magazine, February, 1913.

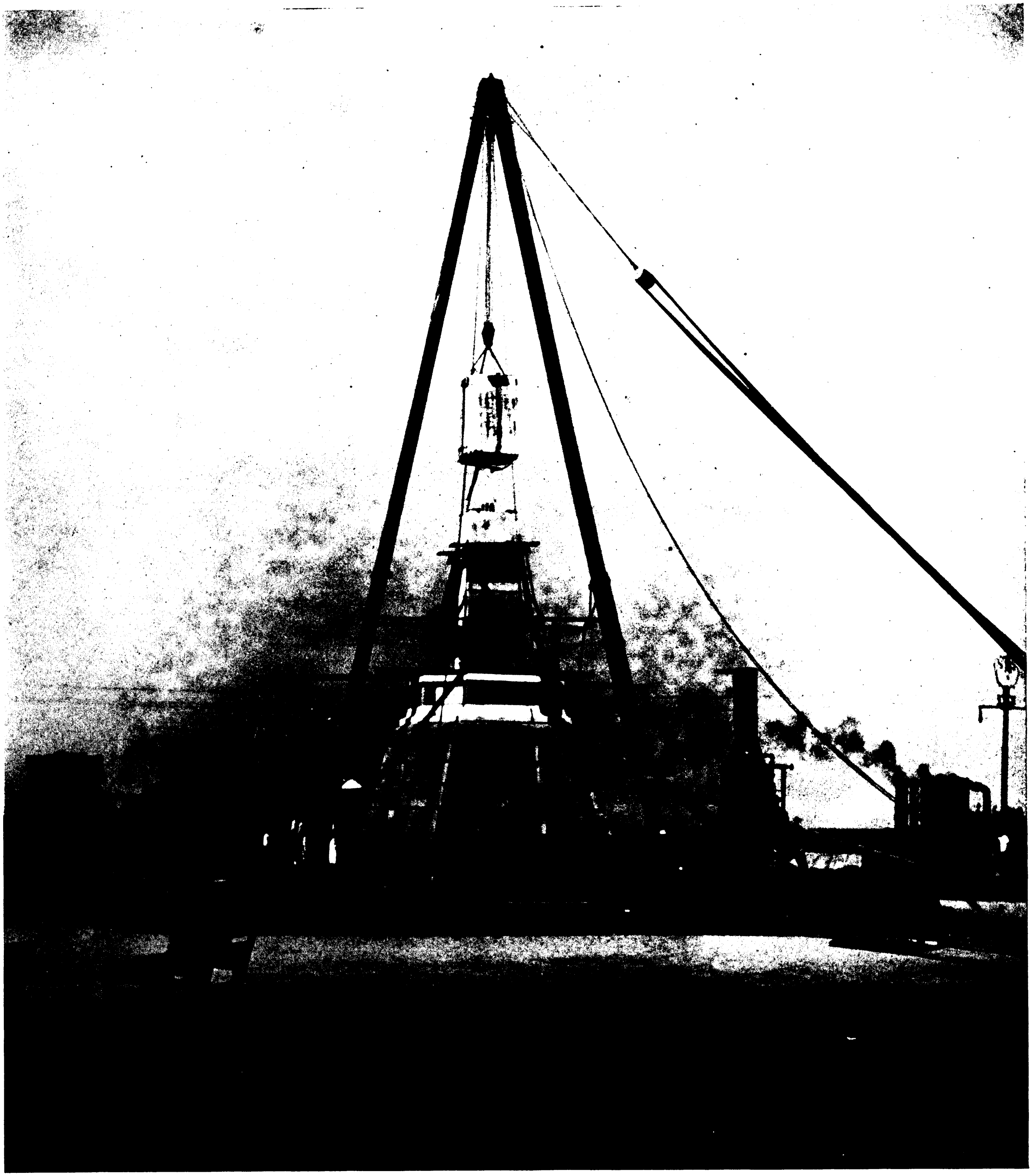
There are hermit souls that live withdrawn,
In the peace of their self-content;
There are souls, like stars, that dwell apart
In a fellowless firmament;
There are pioneer souls that blaze their paths
Where the highways never ran—
But let me live by the side of the road,
And be a friend to man.

Let me live in a house by the side of the road,
Where the race of men go by—
The men who are good, and the men who are bad,
As good and as bad as I.
I would not sit in the scorner's seat,
Or hurl the cynic's ban—
Let me live in a house by the side of the road,
And be a friend to man.

I see from my house by the side of the road—
By the side of the highway of life,
The men who press with the ardor of hope,
The men who are faint with strife.
But I turn not away from their smiles nor their tears—
Both parts of an Infinite plan—
Let me live by the side of the road,
And be a friend to man.

I know there are brook-gladdened meadows ahead,
And mountains of wearisome height;
And the road passes on through the long afternoon,
And stretches away to the night.
But still I rejoice when the travelers rejoice,
And weep with the strangers that moan,
Let me live in my house by the side of the road,
And be a friend to man.

Let me live in my house by the side of the road,
Where the race of men go by—
They are good—they are bad—weak and strong,
Wise—foolish, so am I.
Then why should I sit in the scorner's seat
Or hurl the cynic's ban?
Let me live in my house by the side of the road,
And be a friend to man.



Rizal Monument under construction.

Erected under the supervision of the building division, Bureau of Public Works, J. McGregor, chief of division. Published by permission of the Rizal Monument Executive Committee.

APPENDIX A.

CIRCULAR LETTERS ISSUED BY PROVINCIAL DIVISION FROM JANUARY 1 TO MARCH 31, 1913.

MANILA, *January 15, 1913.*

Provincial Division Circular No. 94.

SIR: I have the honor to invite your attention to the fact that the regulations which govern the installation of sanitary appliances in the provincial buildings are the sanitary regulations of the city of Manila. These regulations, together with a vast amount of other information, which it is believed would be of value to the provincial authorities, are published in the Charter and Revised Ordinances of the City of Manila, a copy of which, paper bound, may be secured for ₱3; the price of the sheep-bound volume being approximately ₱5.

It is suggested that you take this matter up with the provincial board and request that a requisition be forwarded in the regular manner on the Purchasing Agent for the purchase of a copy of the Charter and Revised Ordinances of the City of Manila, for use in the district engineer's office.

The regulations covering the installation of sewer systems, etc., in buildings or municipalities are too lengthy to be incorporated in specifications, and as buildings are being constructed continuously throughout the Islands, the purchase of a volume containing the Charter and Revised Ordinances of the City of Manila will be not only beneficial but economical.

You are directed to take this matter up immediately with the provincial board and notify this office of the result.

Very respectfully,

WARWICK GREENE,
Director of Public Works.
By E. J. WESTERHOUSE,
Chief Division Engineer.

To all DISTRICT ENGINEERS and
DIVISION ENGINEERS.

MANILA, *March 3, 1913.*

Provincial Division Circular No. 95.

SIR: I have the honor to submit for your information the following abstract of an indorsement outlining the duties of the district engineer in his relations with the provincial board of the province:

"The district engineer is designated by law as a public-works agent for the provincial board on all matters pertaining to provincial and municipal public-works projects. The Director of Public Works exercises control over him in all matters pertaining to Bureau policy, engineering, and technical features. The following procedure is outlined for your future guidance:

"1. Work required by the provincial board will be undertaken and executed by the district engineer when the necessary funds are made available and within such time as the exigencies of the case may require; this to be at his earliest convenience without prejudice to the economical and successful prosecution of other projects already under way. Should it be found necessary to delay the inauguration of the new work as directed by the provincial board, they should be advised accordingly.

"2. If, in the opinion of the district engineer, the proposed expenditure is not justifiable, inadequate, inconsistent, or uneconomical, the provincial board must be formally advised thereof in detail and definite instructions requested, with the express understanding that the provincial board thereafter accept all responsibility for having directed that the work be executed.

"3. Any proposal for work required by the provincial board which, in the opinion of the district engineer, is contrary to good engineering practice, technically wrong, a modification of approved plans, or is in direct conflict with the policy as established by this Bureau, should first be submitted to the Director of Public Works for definite instructions and the provincial board advised of such action.

"The best interests of the public service require a spirit of complete coöperation between the district engineer as the provincial representative of the Bureau of Public Works and the provincial board as the highest local administrative authority."

In a large measure, the duties of the district engineer are advisory to the provincial board, and in this capacity his actions at all times should be entirely in the best interests of the public service.

Very respectfully,

WARWICK GREENE,
Director of Public Works.
By E. J. WESTERHOUSE,
Chief Division Engineer.

To all DISTRICT ENGINEERS and
DIVISION ENGINEERS.

MANILA, *March 10, 1913.*

Provincial Division Circular No. 96.

SIR: I have the honor to invite your attention to the inclosed blank form which you are directed to fill out in detail for all temporary employees, such as foremen, overseers, superintendents of construction, inspectors, and other skilled workmen. This should include natives, Americans, and all foreigners so employed. It need not include natives employed as road-roller engineers, carpenters, masons, and similar skilled positions where the employee is receiving less than ₱2.50 per day.

Similar lists have been submitted in the past which in many cases were incomplete. In the list to be submitted you are cautioned to exercise the greatest of care in order that no position may be overlooked. Should you fail to enter an employee on this list and payment questioned at any future time you may be held personally liable for payment made to such employee.

Permanent employees with a classified civil-service appointment should not be included in this list.

The information herein requested must be submitted in sufficient time to reach the Manila office not later than April 15, 1913.

Very respectfully,

WARWICK GREENE,
Director of Public Works.
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS and
DIVISION ENGINEERS.

Personnel data .... *Province.*

Name.	Date employed.	Initial wage.	Present wage.	Present position.	Service.	Education.	Possible development.	Remarks—Work accomplished.

MANILA, *March 14, 1913.*

Provincial Division Circular No. 97.

SIR: I have the honor to invite attention to the prevalent use of motor trucks as a transportation method on first-class roads in the Philippine Islands. The weight of these trucks is constantly increasing, with the result that many in use now are probably weighing considerably over 10 tons with a full load and the likelihood that from time to time still heavier trucks will be installed.

To avoid accidents, prominent signs should be placed on all temporary and provisional bridges stating the limit of the load for which the structure is safe.

You are directed to take immediate action in this matter, securing the province against damages as the result of future accidents through the failure of temporary and provisional bridges.

Very respectfully,

WARWICK GREENE,
Director of Public Works.
By E. J. WESTERHOUSE,
Chief Division Engineer.

All DISTRICT ENGINEERS and
DIVISION ENGINEERS.

MANILA, *March 17, 1913.*

Provincial Division Circular No. 98.

SIR: I have the honor to advise that under date of March 7, 1913, the Honorable the Secretary of Commerce and Police, approved a redivision of the provinces of the Philippine Islands into four engineering divisions, the assignment of division engineers being as follows:

First division: D. E. Henry, acting division engineer; Provinces of Cagayan, Isabela, Ilocos Norte, Ilocos Sur, La Union, Nueva Ecija, Pangasinan, Tarlac, and Zambales.

Second division: E. P. Shuman, division engineer; Provinces of Bataan, Batangas, Bulacan, Cavite, Laguna, Pampanga, Rizal, and Tayabas.

Third division: W. H. Waugh; division engineer; Provinces of Antique, Bohol, Capiz, Cebu, Iloilo, Occidental Negros, and Oriental Negros.

Fourth division: B. Von Schmeling, division engineer; Provinces of Albay, Ambos Camarines, Leyte, Misamis, Samar, Surigao, and Sorsogon.

These assignments will be effective as of April 1, 1913.

Very respectfully,

WARWICK GREENE,
Director of Public Works.

All DISTRICT ENGINEERS and
DIVISION ENGINEERS.

APPENDIX C.

PROJECTS ACTIVE JAN. 1, 1913.

Provinces.	Roads.				Bridges and culverts.				Provincial administration buildings.			Municipal administration buildings.		Prisons.		Schools.				Construction and operation.										Total.
	Construction.	Maintenance.	Repair.	Reconstruction.	Construction.	Maintenance.	Repair.	Reconstruction.	Construction.	Maintenance.	Repair and alteration.	Construction.	Reconstruction.	Construction.	Repair and alteration.	Construction.	Maintenance.	Repair and alteration.	Reconstruction.	Markets.	Parks, grounds, and athletic fields.	Miscellaneous buildings.	Ferries.	Water systems.	Record vaults.	Quarries.	Telephone lines.	Electric light plant.	Miscellaneous.	
Albay	5	2			2	1		3		1		3				38	1			6	1	1							4	68
Ambos Camarines	2	9		1	2	1										2													2	19
Antique	3	2			2				1							2	1													11
Bataan	1	2			1																								1	5
Batangas	3	3			1	1						1				2				2	1									14
Bohol	1	3	1		24											10			2			1		1					3	46
Bulacan	5	3			14											4				5	1	1							2	35
Cagayan	2	2			4	1					1						2												2	14
Capiz	6	2		3	2				1							4	1		2	1	1		3							26
Cavite	3	2			1											6				1										13
Cebu	5	3	1			1										2				1				1					1	15
Ilocos Norte	1	2			4						1					13		3											1	25
Ilocos Sur	4	3	1		5	1										11						2							1	28
Iloilo	2	3		1	3											2				5		1				1			2	20
Isabela	1	2			3											5							1						1	13
Laguna	3	3	1		1			1								10				2						1	1		2	24
La Union	4	2			5											10							1						3	25
Leyte	6	1			10	1			1	1				1		5	1				2	3							2	34
Misamis	4	3		1	5											1												1		15
Nueva Ecija	1	2			3											6				1	1									14
Occidental Negros	7	2			12											5				2		1	1						1	31
Oriental Negros	3	4				3			1	1						3								1					5	21
Pampanga		1			3											1				1									2	8
Pangasinan	3	3			9								2			9			2	1									5	34
Rizal	4	13		3	5											2			1										2	30
Samar	1	5							1							3								1					1	12
Sorsogon	4	3			3	2										4													8	24
Surigao	2	2														3		2		1										10
Tarlac	2	2			4									1		5														14
Tayabas	9	4			3					1		1		1		6					1			1					3	30
Zambales		1			9					1														1					2	14
Total	97	94	4	9	140	12		4	5	5	2	5	2	3		174	6	5	7	29	8	10	6	6		2	1	1	56	692

The 56 miscellaneous projects include 13 surveys and investigations, 2 crushing plants, 1 river control, 1 bituminous road, 2 dikes, etc.

BUREAU OF PUBLIC WORKS

ORGANIZATION

WARWICK GREENE, *Director of Public Works*
C. LINDSEY, *Assistant to the Director*
C. W. HUBBELL (absent), *Chief Engineer*
C. M. PRITCHETT (absent), *Supervising Engineer*
W. L. GORTON, *Chief Irrigation Engineer*
C. W. KEITH, *Chief, Division of Engineering Design*
W. M. HAUBE, *Superintendent Special Projects*
J. MCGREGOR, *Chief, Building Division*
L. L. COOK, *Superintendent Automobile Division, Manila*
J. L. VICKERS, *Superintendent Artesian Wells Division*
MAX DOBBINS, *Statistical Engineer*
J. K. PICKERING, *Chief Accountant*
W. H. WARNER, *Property Clerk*
H. M. JOHNSTON, *In charge of Record Division*
A. K. JONES, *Law Clerk*
MRS. R. D. BENDER, *In charge of Library*

◆

PROVINCIAL DIVISION

E. J. WESTERHOUSE, *Chief Division Engineer*

DIVISION ENGINEERS

FIRST DIVISION .... D. E. HENRY (acting)

PROVINCES

Cagayan
Isabela
Ilocos Norte
Ilocos Sur
Zambales
La Union
Nueva Ecija
Pangasinan
Tarlac

SECOND DIVISION .... E. P. SHUMAN

PROVINCES

Bataan
Batangas
Bulacan
Cavite
Laguna
Pampanga
Rizal
Tayabas

THIRD DIVISION .... W. H. WAUGH

PROVINCES

Antique
Bohol
Capiz
Cebu
Iloilo
Occidental Negros
Oriental Negros

FOURTH DIVISION .... B. VON SCHMELING

PROVINCES

Albay
Ambos Camarines
Leyte
Misamis
Samar
Surigao
Sorsogon

DISTRICT ENGINEERS

Barry, R. L.	Tuguegarao, Cagayan
Root, W. F.	Laoag, Ilocos Norte
Smith, E. D.	Vigan, Ilocos Sur
Baluyot, Sotero	Ilagan, Isabela
White, R. A.	San Fernando, La Union
Morrison, C. G.	Lingayen, Pangasinan
Vallarta, Julian	Balañga, Bataan
Caton, J. H. 3rd	Batangas, Batangas
Harrison, J. L.	Malolos, Bulacan
Bennett, C. R.	Cavite, Cavite
Barry, J. R.	Los Baños, Laguna
Austin, A. W.	Cabanatuan, Nueva Ecija
Randolph, R. W.	San Fernando, Pampanga
Beckjord, J. G.	Pasig, Rizal
Brown, E. C.	Tarlac, Tarlac
Kasilag, Marcial	San Narciso, Zambales
Agcaoili, Romarico	San Jose, Antique
Scheidemantel, L. W.	Capiz, Capiz
Glenn, R. V.	Iloilo, Iloilo
Sylvester, A. T.	Bacolod, Occidental Negros
Miles, H. V.	Lucena, Tayabas
Carpenter, J. C.	Albay, Albay
Powell, O. N.	Nueva Caceres, Ambos Camarines
Clark, L. T.	Tacloban, Leyte
Vance, Chas. F.	Catbalogan, Samar
Lilley, H. B.	Sorsogon, Sorsogon
Boggess, L. S.	Tagbilaran, Bohol
Raider, H. A.	Cebu, Cebu
Allen, R. N.	Cagayan, Misamis
Davis, H. K.	Dumaguete, Orient. Negros
Meehleib, H. R.	Surigao, Surigao